FLIGHT
and
The AIRCRAFT ENGINEER

FIRST AERONAUTICAL WEEKLY IN THE WORLD : FOUNDED 1909

Editor
C. M. POULSEN

Managing Editor
G. GEOFFREY SMITH

Chief Photographer
JOHN YOXALL

Editorial, Advertising and Publishing Offices: DORSET HOUSE, STAMFORD STREET, LONDON, S.E.1
Telegrams: Truditur, Sedist, London. Telephone: Waterloo 3333 (35 lines).

8-10, CORPORATION ST., COVENTRY. Telegrams: Autocar, Coventry. Telephone: Coventry 5210.
GUILDHALL BUILDINGS, NAVIGATION ST., BIRMINGHAM, 2. Telegrams: Autopress, Birmingham. Telephone: Midland 2971 (5 lines).
260, DEANSGATE, MANCHESTER, 3. Telegrams: Iliffe, Manchester. Telephone: Blackfriars 4412.
26B, RENFIELD ST., GLASGOW, C.2. Telegrams: Iliffe, Glasgow. Telephone: Central 1857.

SUBSCRIPTION RATES: Home and Abroad: Year, £3 1 0. 6 months, £1 10 6. 3 months, 15s. 3d.
Registered at the G.P.O. as a Newspaper.

No. 1678. Vol. XXXIX. FEBRUARY 20th, 1941 Thursdays, Price 9d

The Outlook

Fighter Range

CAPT. NORMAN MACMILLAN, in his article this week, refers, among other things to the subject of fighter range. He examines briefly the claims of the different systems which have been proposed for increasing range, and comes to the conclusion that, for the particular purpose he has in mind, the best solution is the straightforward one of increasing the petrol tankage. He does not, unfortunately, explain how the space (which he admits is already taken up by other things) is to be found.

One thing must be clearly realised in studying this problem: it is necessary to distinguish between duration and range. Where the former alone is essential, such as is the case when it is desired to enable a fighter to do a long patrol, speed during that part of the flight which precedes the actual air fight is not very important. Hence the refuelling scheme, the composite and the slip-wing, and Mr. Pemberton-Billing's towed fighter can provide the duration. Moreover, the fighter with low power loading does not require assisted take-off in the way that a heavily loaded bomber needs it. Even with an overload of fuel, the fighter should be capable of getting into the air under its own power, so that if the fuel can be accommodated the range can be achieved.

Long-range Tanks

IT seems logical to assume that if tank space cannot be found inside the fighter, it must be found outside it. That seems to be inferred in Capt. Macmillan's somewhat tantalising remark "There are several ways of adding tankage without adding too much resistance." We may be a bit dense, but we can only think of two. There is the very obvious one of an external tank, streamlined to reduce the drag. That is almost as old as flying itself, for did not Henry Farman have cylinders with petrol on the top of his lower wing when he made his first world's duration record, and it has been used on innumerable occasions since. The only refinement which comes to mind for application to modern conditions is the arrangement of means for jettisoning the tank when it has served its purpose. Extravagant, but justifiable in wartime. Besides, the tank could, if necessary, be made of wood or some other non-metallic material. An alternative method might be to make the tank of some form of impregnated fabric, so arranged that when it was empty the tank could be "collapsed" and its extra resistance saved in order to give the fighter its maximum performance when the fuel had been reduced to that carried in the normal internal tanks. (A non-technical member of our staff makes the facetious suggestion that the extra tank might be towed behind the fighter, supported by a small pair of wings and stabilised by normal tail surfaces. In other words, a sort of producer gas plant trailer arrangement!)

Hitting the Night Bomber

IN a broadcast the other night Air Commodore Goddard said that since June over 140 night bombers had been "collected into the bag, apart from those in Davy Jones's locker." Few people can have realised that our night defences were so effective. An average of twenty night bombers a month for certain, in addition to those which we have destroyed without being able to count them, is not an unsatisfactory result. Naturally it does not compare with the high totals amassed by the Fighter Command last summer in the daylight raids, when German bombers and fighters came over in swarms, offering targets such as delight the hearts of sporting fighter pilots and of A.A. gun crews. We ought not to forget that in those lurid months our A.A. gunners

made a worthy contribution to the total of enemy machines destroyed. We must also admit that the present rate of destruction is not sufficiently high to break the spirit of the German pilots. We acknowledge that they are determined men, but at least the German crews cannot set out on a night raid over Britain with the comforting assurance that there will be no danger and that all of them will in a few hours be back at their bases, enjoying breakfasts of French good things, or at the worst German *ersatz* sausages.

In the published reports it is noticeable that many of the night bombers which our A.A. gunners have brought down have fallen on or near the coasts. This suggests that some of them, perhaps most of them, have been wingd by the fire round the cities which they have raided, and that they had lost speed and height as they wended their way homeward. It is also to be noted that the number shot down by night-fighters is slowly on the increase. That is at least significant.

Aid from the United States

IN this issue we publish an article surveying the precise amount of help in the shape of military aircraft which America has been sending to us. It is written by an engineer, and the training of such people is designed to make them think in exact figures and not approximations; "near enough" is not their motto. The article is an exhortation to all Americans engaged in any aspect of aircraft manufacture to give us as much of their efforts as possible, and the title echoes the concluding phrase of Mr. Churchill's recent dramatic broadcast speech.

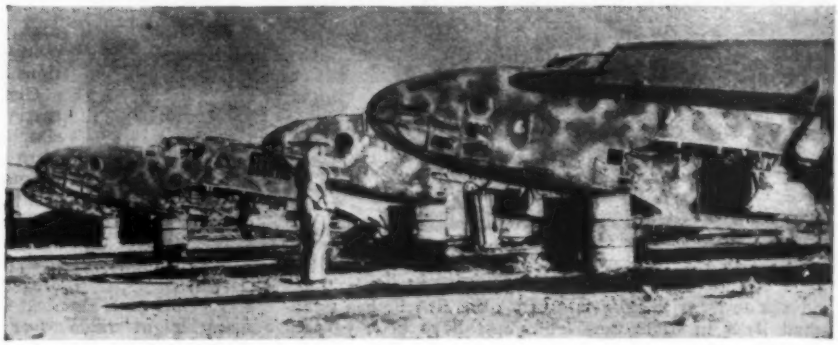
Though addressed to Americans, the figures contained in this article will be read with interest by many in this country, for the British public has been very much in the dark about just how many aircraft are coming across the Atlantic. Ironically enough, they are the only ones who have been in the dark, for the article points out that both the Germans and the Americans have always been fully informed by the release of official figures. Also, such approximate figures as have been stated here are now seen to have been far too high. We wonder if the recent statement of Col. John Jouett, of the Aeronautical Chamber of Commerce of U.S.A., that "400 aircraft have been flown across the Atlantic" is in the same category, for this figure looks high when compared with the monthly export figures contained in the article. (The average from July to November is 190 per month.) But whatever the exact number flown over, it is indeed an illuminating commentary on the progress of flight that these multiple crossings of the world's greatest ocean are now accepted as almost commonplace. Bombers are coming in a small but steady stream, but fighters must be brought by ship owing to their short range and strictly limited crew accommodation. A most important characteristic of delivery by air across the Atlantic is that it is out of reach of interference by submarine, and releases shipping for other purposes.

The quality of American aircraft is above complaint—no cheap and nasty aeroplanes these, and though, except for the proved and trusty Hudson, they have not yet been tried out extensively in battle, and although they are not of the very latest types, our description in last week's issue of a mock combat between a Hurricane and a Curtiss Tomahawk left no doubt that *Flight's* opinion of them is high. What we want is more and more of them.

ONE OF NEW YORK'S TWO AIRPORTS. La Guardia Field has only been in use for about a year, but the arrivals and departures already tax its capacity. The Douglas DC-3 seen in flight over the airport is one of the American Airlines fleet.

War in the Air

A Blinded Army : H.M.S. "Ark Royal" at Genoa : South African A.F. Record



PART OF THE CONSIGNMENT : At El Adem aerodrome in Cyrenaica the Italians left no fewer than 86 aircraft of various types. Our photograph shows a row of twin-engined Bergamaschi "Ghibli" monoplanes.

IN the last issue of *Flight* comment was made on the handicap which the Italian Generals in Libya must be suffering through the complete collapse of the *Regia Aeronautica* and the resultant absence of any reliable news of the movements of General Maitland Wilson's troops. A striking case of this was the fierce three-day battle to the south of Benghazi. The Italians decided not to defend that important place, but to withdraw their troops to the west. Possibly Marshal Graziani is regretting that he did not adopt such a policy earlier in the day: he had allowed the British to eat up many thousands of his troops piecemeal—but even to run away successfully is not easy when the Army of the Nile is on the move. Anyway, General Tellera, the commander of the Italian 10th Army, together with that expert escapist, General Berganzoli of the Electric Beard, and others, made an effort to march away down the coast and try to fall back on the Italian Army in Tripolitana.

They Did Not Know

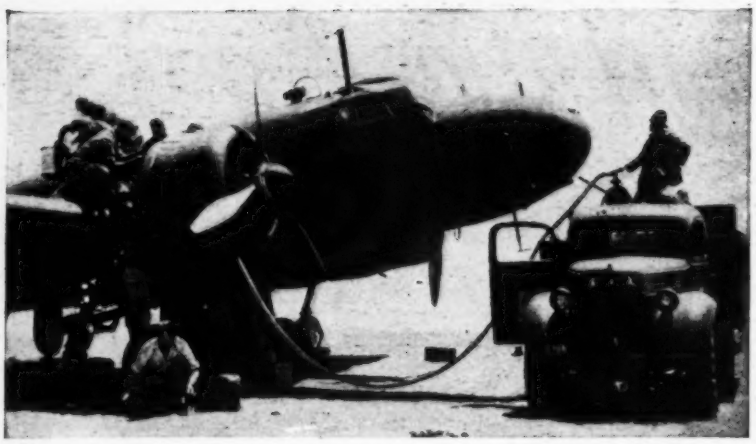
THE trouble was that they did not know what the British were doing. They believed that all the British forces were coming along the circular coast road which leads up to Benghazi. Perhaps they knew (they must have known) that there was an indifferent track which ran straight across the "string of the bow" to the south of the peninsula on which Benghazi stands. They did not know that a mechanised British column was hurrying along that track at a speed for which the annals of desert warfare provide no precedent. Everything was sacrificed to speed. The discomforts of the rough track must have been acute. Vehicles which broke down were left behind (they can be recovered and repaired later), while their crews jumped on to others. The men were cut down to a ration of about half a pint of water a day. It was a sheer frenzy of haste.

Had Italian aircraft been fulfilling their basic duty of acting as the eyes of the Army, the Italian Generals must have known of this flank march by the British. But no eyes in the air reported it. On Benina aerodrome, near Benghazi, 86 unserviceable aircraft were lying on the ground, and the Italian Generals were left in the dark. The British column got across the Italian line of retreat just in time, and a desperate battle took place, which raged for three days. The enemy fought with greater fierceness than they had shown in any previous engagement, and they outnumbered the British. The latter scored by the skill of their manœuvres, and avoided heavy casualties. The Italian commander was killed, General Tellera was mortally wounded, and, finally, General Berganzoli and the rest surrendered.

H.M.S. *Ark Royal* has not, strange to relate, been sunk again. The Italian airmen had shots at her as she took part in the Fleet's raid on Genoa, Leghorn and Pisa. On board her during the action was a special correspondent of *The Times*, who has sent to his paper a fine graphic account of the action. It was a daring, almost one might call it a cheeky, affair. Whether Hitler had actually proposed to embark at Genoa a German force for the invasion of French Tunisia cannot be said with certainty, but as the suggestion was allowed to creep out it may be supposed that the British Government had suspicions amounting to more than a mere conjecture. So Britannia gave a little demonstration of who rules the waves in the Mediterranean. The squadrons in the *Ark Royal* took off from the flight deck before dawn, and as the light was breaking they reached Leghorn and dived on to the Azienda works, where oil is distilled from coal. H.E. bombs were followed by a shower of incendiaries, and fires broke out everywhere. The aerodrome and railway junction at Pisa were attacked at the same time. The coast in these parts is protected by a balloon barrage, but the naval airmen treated it with scant respect. One of our machines was lost, but whether from A.A. fire or from a balloon cable is not known. Meantime the warships, including the battleship *Malaya* and the battle cruiser *Renown*, which between them mount fourteen 15in. guns, were bombarding the harbour of Genoa and the Ansaldo arms factory with great accuracy. It was Sunday morning and so there were not likely to be many civilians about, especially at that early hour. The guns of the place first thought that the attack was coming from the air and fired straight upwards. When the gunners noticed the British fleet they altered their aim, but did not hit a ship at all. The Italian Navy did not show up; it had been hoped by the British that it would at least try to avenge this daring raid as the British ships retired. Some Italian airmen took the air and two of their machines were shot down by the fighters from the *Ark Royal*. Two others dropped bombs at the carrier, but missed her as usual. After the action Vice-Admiral Somerville, in his signal to the Fleet, congratulated the *Ark Royal* and her aircraft on "a most valuable contribution." Altogether 300 tons of shells had been fired into the targets at Genoa.

The Fallen Colossus

RHODES has been attracting a lot of attention of late from the Middle East bombers, and the aerodromes at Calato and Maritza on that island have several times been bombed and machine-gunned. Before Italy entered this war, observers who had an exaggerated respect for the *Regia Aeronautica* were wont to comment on the fine strategic position which Italy had secured by annexing the Dodecanese group of islands. They made a most useful half-way house between Italy itself and Syria, and bombers from the islands would be able to destroy the oil pipe-lines in Syria. Actually the Dodecanese have proved a liability



MADE IN GERMANY: Overhauling and refuelling a Junkers 86 K in service with the South African Air Force.

and not an asset to Italy, and since the R.A.F. has established itself in Crete the Dodecanese have been isolated from Italy. There has been little or no chance of replenishing the petrol and oil supplies on the islands, and some of the latter actually depend on imports of drinking water. The Fleet Air Arm and the R.A.F. have made raids on them every now and again, but recently the attacks have grown more frequent and more heavy. This may indicate that the number of bombers in Crete has been increased.

The Fight for Keren

THE invasion of Eritrea is progressing, and a new invading column of British troops has entered that colony from the north. The main interest of late has centred round the assault on Keren. This town stands on high ground and is strongly fortified. The Italians have reinforced the garrison and the task before our troops has not been simple. The Indian division or divisions, experienced in mountain warfare from their constant scrapping on the North-West Frontier, are just the right sort of troops to tackle such a job, and at the moment of writing they have fought their way up hills round the town. It is good to read that in this stiff fighting the infantry have received help from R.A.F. bombers, which can attack even lofty strong points from above. The bombers have also been interfering with the communications between Keren and Asmara, the capital. Stores in a wood near Keren were discovered and duly bombed.

It is quite a far cry from Eritrea to Southern Abyssinia and Italian Somaliland, where another lively campaign of invasion is going on. It is there that the South African Air Force is operating.

There is not an important aerodrome in Italian Somaliland and Southern Abyssinia which does not bear scars inflicted by the South African Air Force during its first six months of intensive operations. Since Italy entered the war, bombing squadrons of the S.A.A.F. have flown thousands of miles over featureless, desolate country, destroying hangars, administrative buildings, wireless stations, fuel and ammunition dumps, and wrecking and damaging enemy planes "on the deck." Innumerable photographs confirm the damage that has been inflicted. As many as twenty major bombing operations have taken place in one month.

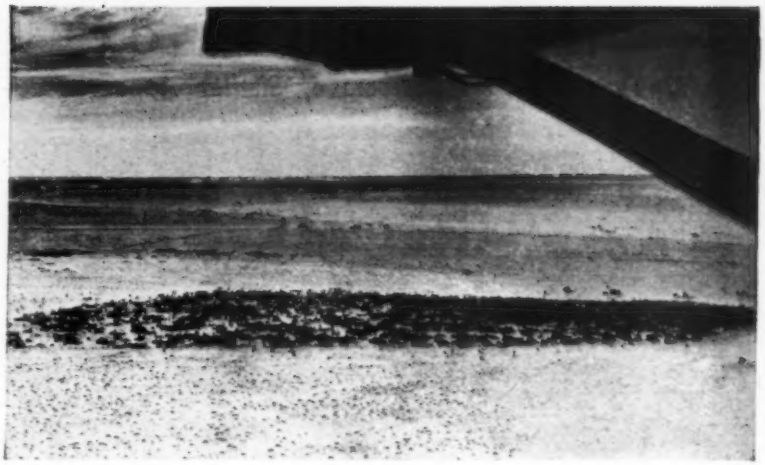
One of the most ambitious raids carried out during August was when simultaneous offensive reconnaissances were made against all Italian aerodromes within striking range of Kenya. Nine days later, a most spectacular attack was carried out by waves of S.A.A.F. bombers, which dived on the main transport yard at Mogadiscio and set fire to more than 800 vehicles. Bomber squadrons have also carried out many night raids over this difficult flying country. Although they have not been in dog-fights such as occur over Germany, England and Northern Africa, pilots of the S.A.A.F. fighter squadrons have an impressive six months' record. Ever since the first Italian bomber was shot down in Kenya at Wajir on August 3, fighter aircraft have been successful in intercepting most of the bombing raids which the Italians have ventured to make over the vast northern frontier district. On October 25, three S 81s were engaged and shot down by three S.A.A.F. fighters, and one month later three Capronis were intercepted and two shot down, and a third believed damaged.

Impressive as are the records of fighters and bombers, the outstanding feature of the S.A.A.F.'s six months in East Africa has been the work of Army Co-operation squadrons, which daily make low, hazardous reconnaissance and photographic flights over enemy territory. Among their numerous duties, Army Co-operation squadrons include bombing and fighting. In the attack on El Wak, the success of which was largely due to the fact that air and land forces acted in perfect unison, it was the Army Co-operation squadron which shot down a Caproni before it had a chance to "lay its eggs." The outstanding successes of the South African Air Force during its operations in Africa show that its general organisation is highly efficient and that the skill and courage of its pilots unquestionably entitle them to the highest praise.

It seems that the numbers of the Greek flying corps have been growing of late, probably through the help of Britain. The Greek airmen have never lacked enterprise and

FINISHED IN ENGLAND: A Junkers 87 dive-bombing Stuka which came unstuck after an interview with some Spitfires

THE WAR (Continued)



THE ANT HEAP: An air picture of the Italian prisoners captured at the battle of Bardia.

courage, but there were too few of them. Recently, however, two Greek fighter squadrons of seven machines each were escorting a force of Greek bombers which made successful attacks on enemy concentrations. On the return journey the Greeks ran into a force of some 15 enemy bombers with a fighter escort. The Greek fighters gained height and dived on the enemy. The fight is reported to have lasted half an hour, and the Greeks shot down eight Italian machines, apparently without loss to themselves. This was the first major air battle fought by the Greeks alone.

Another of our Allies has also been doing well in the air. The Free French forces in Chad have made another raid into South Libya, this time with a mechanised force and bomber aircraft. They attacked oases in the Kufra area, some 600 miles from the Chad frontier, and after the Free French bombers had raided an Italian air base and destroyed enemy machines on the ground, the mechanised forces stormed the place. The enemy are stated to have suffered severe losses.

Mr. Churchill's warning words about the German penetration by "tentacles" into Bulgaria has naturally caused no little stir. The Balkan countries (excepting glorious Greece and steadfast Turkey) are like the Scandinavian and Low Countries in their refusal to combine in time against the aggressors, each hoping that it will be the last to be eaten up. The modern vultures are gathering to the feast, for numbers of Ju 52 troop-carriers have been seen flying from Austria over Hungary towards Rumania. Experience elsewhere has taught what fell use Germany can make of air-borne troops against a people who are not prepared to deal with them quickly and efficiently.

The End of the Lull

THE bad weather of winter caused a lull in night operations on both sides, and people on this side began to wonder if the real reason was that the wily Göring was hatching some new plot of frightfulness. To reassure the doubters, Air Marshal Sir Richard Peirse, the A.O.C.-in-C. of the Bomber Command, stated officially that the bad weather alone was the cause. Open weather returned in the middle of February, and at once the Bomber Command got busy again, hammering away in considerable strength at targets on the enemy's side. Hanover attracted special attention for several nights, and, of course, the invasion ports were raided. Daylight raids with fighter protection were made on several occasions, and once the Navy helped the good work by shelling the harbour of Ostend. Boulogne received some heavy and destructive bombing from the air.

Some surprise was caused when the Germans did not at once resume attacks on Great Britain on anything like a heavy scale. They reverted to sporadic raiding of the "nuisance" variety, and in the course of it steadily lost a small number of bombers. By night the A.A. guns did most of the damage, but night fighters also accounted for several raiders. No doubt the moon helped them. Speculation has naturally been aroused as to whether, after all, Hitler has not decided to throw his main force on to the Mediterranean front, and may have moved the best part of his air strength down in that direction. Negotiations with Bulgaria and Jugoslavia have been taking place, and they may be followed by a German advance. None the less, it would not do for Britain to relax her preparations to resist invasion. Hitler usually strikes suddenly, and, when he can, in the least expected direction.

Britain, however, sprang a surprise by dropping some parachute troops in Southern Italy, and they seem to have done some damage, for the railway system was at once thrown out of gear. The Italians have announced that they were all taken prisoners of war—they were all wearing British uniforms. The Ministry of Information has merely admitted that the incident did take place, and that "some of the men have not returned to their base." For the rest it declines to be drawn, so we must await to hear the full story at some future date. But with this incident coming hard on the audacious bombardment of Genoa, the nerves of the good people in Italy (and they are good people for the most part) must be getting somewhat frayed, wondering what the British will do next.

WHERE DO WE GO TO FROM HERE?: The air crew of a Whitley go into a huddle over the night's operation.

AIR LOSSES TO FEBRUARY 15.

	GERMAN	BRITISH		MIDDLE EAST	
	Aircraft	Fighters	Pilots	Enemy Aircraft	British Aircraft
Feb. 9	3	—	—	11	4
,, 10	1	3	3	100	—
,, 11	—	2	2	11	—
,, 12	1	—	—	4	—
,, 13	—	—	—	57	2
,, 14	1	1	1	3	1
,, 15	3	2	2	—	2
	9	8	8	186	9

The fighter losses include those in sweeps over France.

British bombers lost over enemy territory: Feb. 9, 1; Feb. 10, 4; Feb. 11, 2; Feb. 14, 1. Total: 8.

Enemy losses in Middle East include machines captured on aerodromes.

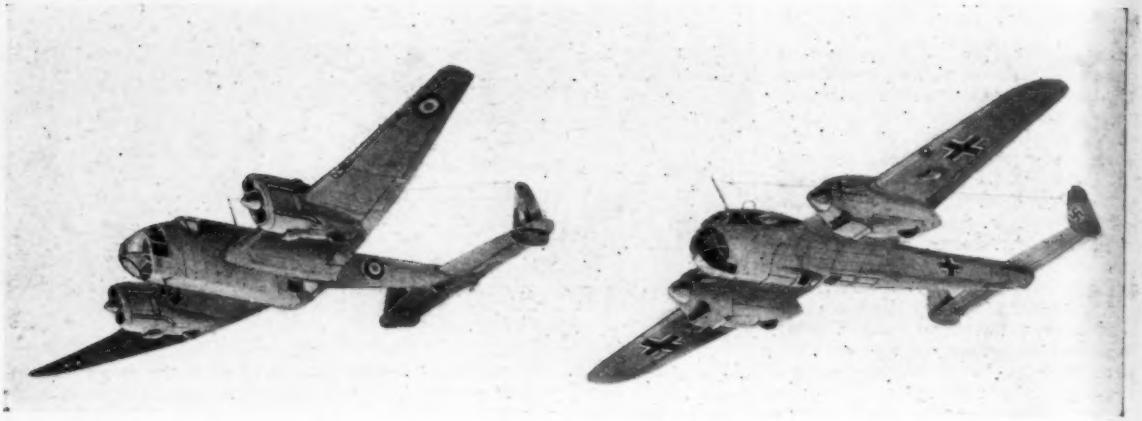
German losses by R.A.F. and ground defences in Northern Area 4,233. R.A.F. aircraft lost in Northern Area, 1,745.

In the Middle East the R.A.F. have destroyed about 997 enemy aircraft and have lost 104.

Seventh of the Series

FRIEND or FOE?

Two Opposing Bombers of Similar Appearance; Points of Difference



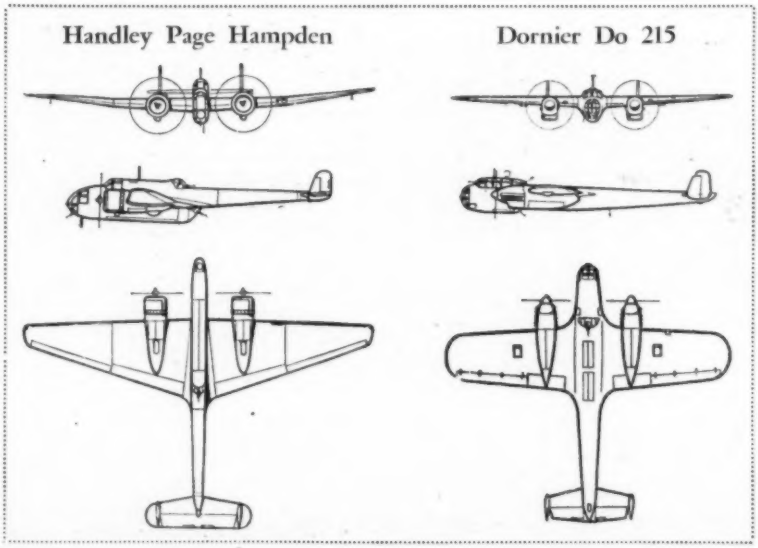
Handley Page Hereford. Wings taper sharply on trailing edge and have swept-up outer panels. "H"-shaped in-line engines. Fuselage greatly diminished in section behind wings. Twin fins and rudders inboard from tailplane tips. Gun turrets amidships, above and below.

Dornier Do 215. Wings, which taper gently to rounded tips, are mounted at the shoulder and have thick roots but no dihedral. Inverted, in-line engines underslung. Gun position at rear of pilot's cabin and in under-turret. Twin, outrigged fins and rudders.

THANKS to their rounded noses with transparent panels and the "tadpole" effect of their fuselage design, the Hereford and the Dornier can very easily be confused, by any but an expert spotter, except when the wing plan is clearly visible. The wings of the British machine (and this also applies to the Hampden, which is identical except that it has radial engines—as shown in the small drawings) have a straight leading-edge and a sharply tapering trailing-edge that brings the tips almost to a point. Those of the Dornier, however, taper very slightly to well-rounded tips. When seen head-on, the Hereford's wing has a pronounced up-sweep to the outer panels and, by virtue of the deep bomb bay which ends amidships in an under-turret, appears to be anchored midway. This contrasts with a similar view of the Dornier, which is the only bomber in the *Luftwaffe* to have "shoulder" wings. These taper out from thick roots faired into the fuselage by fillets.

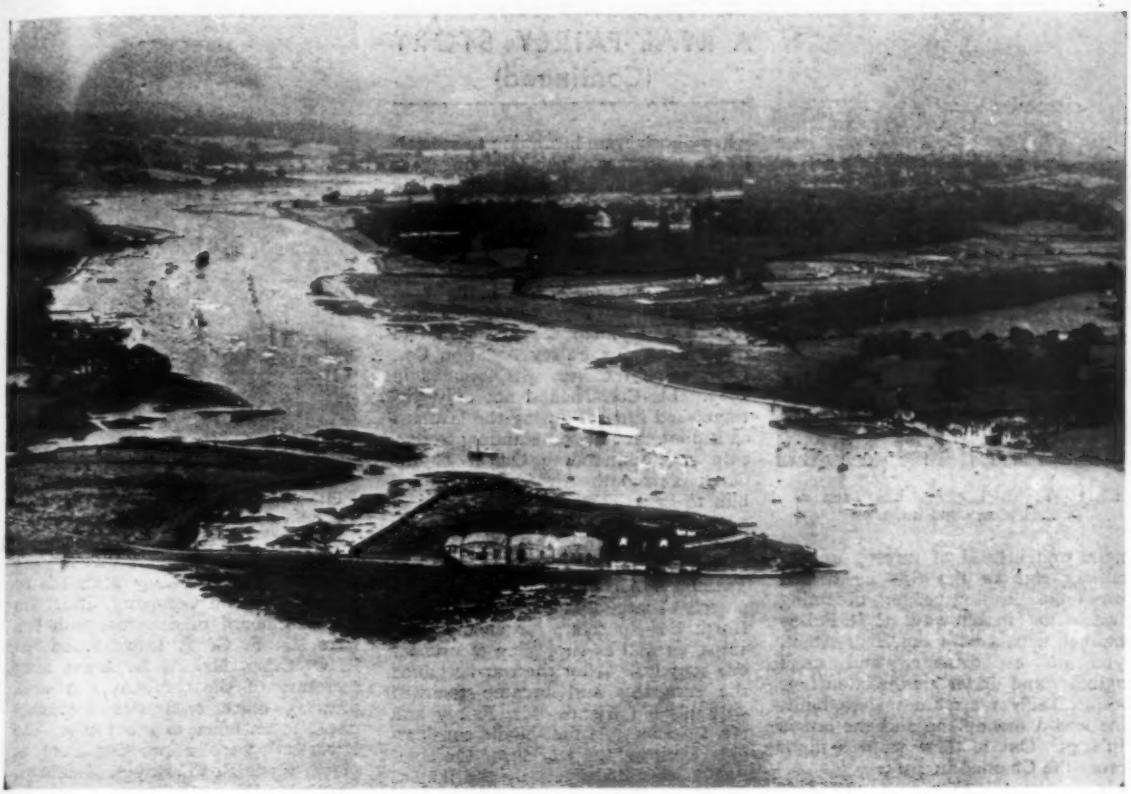
Both having in-line engines increases the similarity of the Hereford and the Dornier in flight, but a second look will show that the "H"-shaped Dagger units of the former are mounted symmetrically on the leading-edge, whereas the inverted Vee type engines of the Dornier are underslung, current models having "beard" radiators. Both fuselages have, from a side view, rounded noses with transparent panels, but that of the Hereford is, when seen head-on, deep and narrow, while that of the Dornier is fairly wide and oval in cross-section. The deep forward portion of the Hereford fuselage reaches much farther back than that of the Dornier, so that its gun-turrets above and below are approximately level with the trailing edge of the wing at its root. But in the German machine the equivalent gun positions are more or less in a line with the leading edge of the wing, the "glass-house" above and the bomb bay below being very much shorter than in the British design. The German "tadpole," in fact, has much the smaller "head." On the Hereford, also, the reduction in fuselage section aft of the gun-turrets is far the more pronounced, dwindling as it does to little more than a boom. Final confirmation of identity is provided by the twin fin and rudder assemblies, each following characteristic practice in that the British machine has its rudders set inboard from the tailplane tips, while those of the German are outrigged.

Very similar to the Do 215 is the Do 17, which has a slightly modified transparent nose panel, an upper gun-turret which projects slightly above the pilot's cabin, but no under-turret to increase the depth of the fuselage in front. This design led to the nickname of the "flying pencil." Confusion between the Do 17 and a Hampden or Hereford is, therefore, far less likely.



Types already compared: (1) Hurricane and Me 109; (2) Spitfire and He 113; (3) Beaufort and Ju 88; (4) Lysander and He 126; (5) Lockheed Hudson and Me 110 and Jaguar; (6) Avro Anson and Focke-Wulf Fw 187.

Next week: Bristol Blenheim IV and Heinkel 111K.



EARLY BEGINNINGS. The Fairey works on Hamble Point as they appeared in 1916. It was here that all Fairey seaplanes were flight tested.

A REAL FAIREY STORY

The History of a Famous British Aircraft Firm Through Twenty-six Years

THE Fairey Aviation Company, Ltd., was formed during the last war, and so this seems an appropriate time for recalling its history, a history which has been full of events, which has seen an astounding number of successes, scarcely a single failure, and which long ago placed the company in the very forefront of British aviation. Nor has the success been confined to this country. For many years before the war a lively export business helped the firm not only to obtain vast experience of the requirements of overseas markets, but it assisted the nation through the lean period when industry was at a low ebb. By way of still further strengthening a reputation established by Fairey products abroad, a separate company was formed some years ago in Belgium.

However, this is anticipating, and for the early beginnings we must take our readers back to the "heroic" days. Even in those days he was interested in flying and model-making, and model-flying soon became his favourite hobby. Perhaps this fact explains the generosity which Fairey showed in after years to model enthusiasts when he repeatedly placed his great aerodrome at Harmondsworth at their disposal for the culminating model-flying competitions of the year. Surely never in the history of model aeronautics have clubs had such a marvellous ground for their contests.

Pioneer and founder of a famous firm : Mr. C. R. Fairey, M.B.E., F.R.Ae.S.

For a time, but only for a time, Dick Fairey was content with model aeroplane flying as a hobby. By 1911 (he having by then reached the "mature" age of 24) he decided that there was much more than a hobby in flying. He became a frequent visitor to the old Aero Club (it had not then received the Royal prefix) aerodrome at Eastchurch, Isle-of-Sheppey, where the brothers Short were doing their constructional work and test flying, and where also was located the Blair Atholl Syndicate.

The latter concern was building a very peculiar aeroplane to the designs of Col. J. W. Dunne. Automatic stability, or as it was termed in those days "inherent stability," was a feature much sought after. Not unnaturally so, for little was known of controllability, and obviously the pilot would be saved a great deal of worry and work, not to say risk, if his machine could be persuaded always to right itself without any interference from him.

Mr. Handley Page attacked the problem by using a crescent-shaped wing with upturned tips. Col. Dunne did away with the tail altogether but swept the wings back at a very sharp

A REAL FAIREY STORY
(Continued)

Major T. M. Barlow, has been a director since 1929.

angle, and instead of turning up the trailing edge of the tips he turned down the leading edge, obtaining "wash-out" in that way. C. R. Fairey obtained a post with the Blair Atholl Syndicate as manager and chief engineer, and under his direction four Dunne Tailless machines were built. One was a monoplane and the others biplanes. One of these made a flight across the Channel in 1913.

It was during that year, too, that Mr. Fairey first met three Cambridge undergraduates: Vincent Nicholl, Maurice Wright, and F. G. T. Dawson. All three were destined to join Mr Fairey in later years, and to help him establish the reputation of the company he was to found. These three were frequent visitors to Eastchurch and Brooklands, and at one time were the proud owners of one of the first fully controlled gliders in England.

Having, as he saw it, finished his task with the Blair Atholl Syndicate, Mr. Fairey joined Short Brothers as chief engineer. This was in 1913, when Shorts were beginning to specialise on seaplanes. The following year war broke out, and while Mr. Fairey continued his work with Shorts at Rochester, Wright, Nicholl and Dawson joined the Royal Naval Air Service, each making his contribution to the victorious outcome of the war. Mr. Dawson saw service in the Mediterranean and joined the first board of directors of the Fairey Aviation Co., Ltd., when the firm was founded in 1915. Lt. Col. Nicholl not only distinguished himself during the last war as a pilot, but his outstanding leadership as Commanding Officer of the Great Yarmouth Air Station proved him to be as completely successful in administrative work as had been his individual feats of gallantry. It may be added that the staff of the Great Yarmouth Air Station organised the patrols of large flying boats across the North Sea to scout for enemy warships, as well as supplying escorts for our convoys. After the war he joined the company and became reunited with his old friends, Mr. Fairey and Mr. Dawson. At first he did considerable work on the testing of the company's aircraft, especially the famous III Ds.

Reunited

Maurice Wright did very important work during the Great War (in the Near East), and was chief test pilot at the Admiralty, and chief technical officer at the Marine Aircraft Experimental Establishment at Felixstowe. He joined the Fairey Aviation Co. in 1925, and thus once again these four enthusiasts came together. How far their enthusiasm has carried them and the firm is proved by the success, financial as well as technical, of the company.

But again we are running somewhat ahead of our story. It was in 1915 that Mr. C. R. Fairey founded the Fairey Aviation Company, Ltd. On the first board of directors with him were Mr. F. G. T. Dawson and Mr. C. O. Crisp, Mr. A. A. Amos being secretary of the company. A small drawing office staff was accommodated in an office in Piccadilly. The "works" were a wooden shed at North Hyde Road, Hayes, Middlesex, which Mr. Fairey took over from the Army Motor Lorry Company.

The first seaplanes were constructed in the small shed at Hayes, but at the same time the drawing office in Piccadilly was started on work on new designs. Mr. Fairey realised from the beginning that it was essential to have a seaplane base if he were to be successful with his seaplane production and experiments. He therefore acquired the Admiralty sheds at Hamble Point on Southampton Water. The erecting shops were built there and a slipway was constructed by which the machines could be lowered into the mouth of the Hamble River.

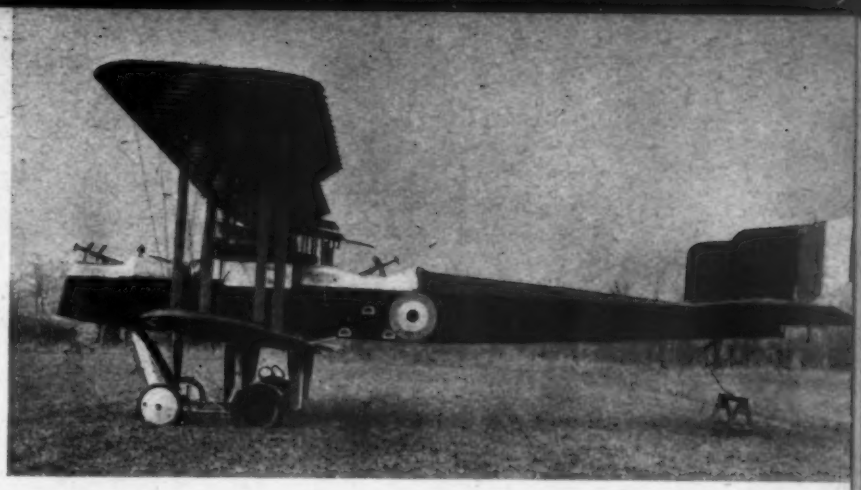
Flt. Lt. L. Massey Hilton, D.F.C., A.F.C., is technical director of the firm.

Mr. C. C. Vinson, B.A., A.C.A., is a director and secretary of the Fairey company.

Sqn. Ldr. M. E. A. Wright, B.A., A.F.C., became a director after leaving the R.A.F. in 1925.

Mr. W. Broadbent, who has been a director for many years, was works manager in the early days of the company.

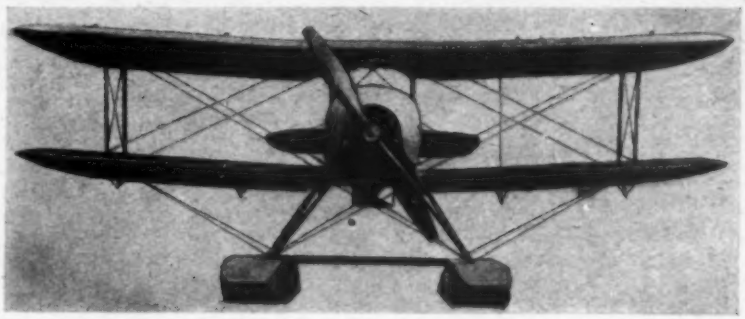
A REAL FAIREY STORY
(Continued)



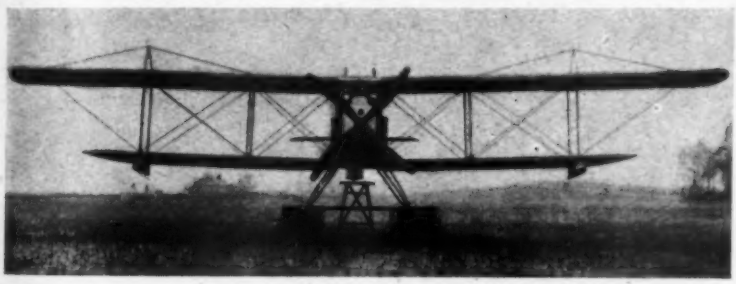
The first Fairey aeroplane of original design was the F.2, produced in 1917. It had two Rolls-Royce engines of 190 h.p. each.

The first test pilot of the Fairey Aviation Co. was Mr. Sydney Pickles, an Australian, and he carried out the flight tests of the Fairey-built Shorts at Hamble during the latter part o 1915.

It soon became obvious that the original small shed at Harlington was much too small if aircraft were to be built in any quantities. To enable it to fulfil a Government order for 100 Sopwith aircraft, the company took over a factory in Clayton Road, Hayes, from the Army Motor Lorry Company. These aircraft were built in just over six months, and each machine was erected and flight-tested at the Kingsbury aerodrome. This factory was turned into manufacturing shops and the original shed was used only for final erecting and experimental work. This was in 1916. During this year Mr. B. G. Slater took charge of the Hamble works and these were turned mainly on to the manufacture of wings and floats and were also used for experimental work and carrying out repairs.

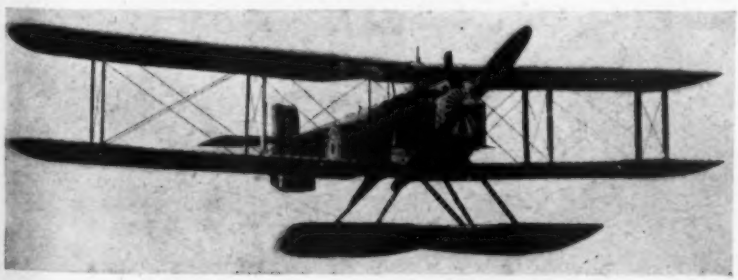


The Hamble Baby (110 h.p. Clerget) was in production early in 1917. It had a three-float undercarriage and Fairey variable-camber wings.



Campania was the name given to a large seaplane built to an Admiralty specification in 1917. The engine was a Rolls-Royce of 250 h.p.

While this work was going on at Hamble, the drawing office began design of an original landplane which later became known as the F.2. This was a twin-engine fighter intended to act as an intermediary between the heavy bomber and the standard two-seater reconnaissance aircraft of the period. It had two Rolls-Royce engines of 190 h.p. each and the loaded weight was 4,680 lb. The wing loading was only 6.8 lb./sq. ft., but in spite of this the speed was 93 m.p.h. An interesting feature of the F2 was that the wings were arranged to fold. The undercarriage also showed signs of originality and was the first step towards the tricycle undercarriage system

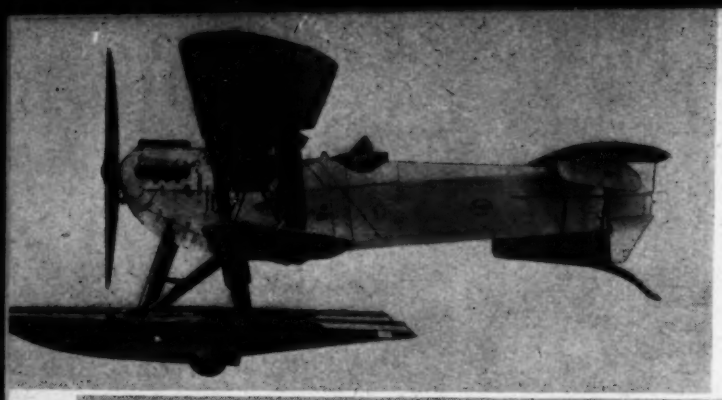


Forerunner of a famous line was the N.10 (260 h.p. Sunbeam), from which was developed the long Series III "family," which culminated in the III F and Gordon. It was built in 1918.

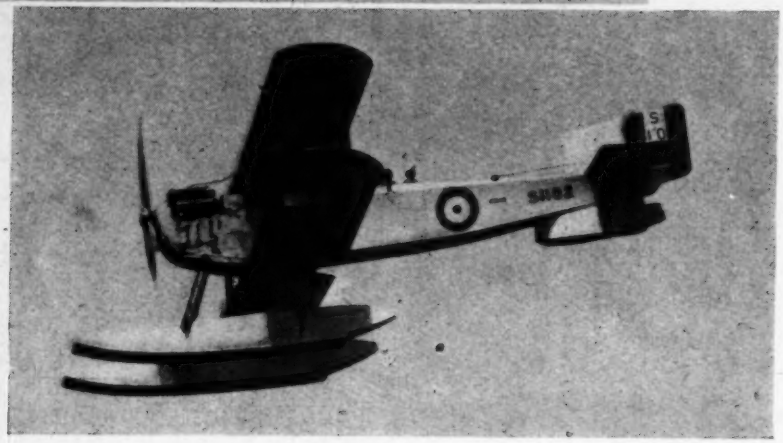
(Right) **The racer entered for the 1919 Schneider Trophy contest. It had a Napier Lion of 475 h.p. It was piloted by Lt. Col. Vincent Nicholl.**

"Flight" photograph

A REAL FAIREY STORY (Continued)



The first Fairey amphibian (1920) was the Pintail, with 475 h.p. Napier Lion, shown on the left. The wheels were partly housed in the steps of the floats.



One of the most popular of the series was the type III D with Lion engine, which appeared in 1921. A similar machine with 365 h.p. R.-R. Eagle engine crossed the South Atlantic in 1922.

"Flight" photograph.

now employed. The four-wheeled chassis was an invaluable aid to safe landings at night on rough ground, for with the front pair of wheels well forward of the centre of gravity, the danger of nosing over was eliminated. The armament consisted of Lewis guns carried on two Scarff gun rings.

A few experimental flights of the early Fairey landplanes were carried out at Harlington, near the works, but the ground was not satisfactory and permission was obtained from the Government to use Northolt Aerodrome for testing purposes and a shed was set aside for them there.

First Flap Gear

Mr. Fairey's first seaplane design became known as the Hamble Baby. Among the very difficult requirements stipulated by the Admiralty was that their seaplanes should be capable of being stowed in a very small space. At the same time it was desired that a large useful load should be carried, and also that the machine should be able to land at very low speed. To meet these difficult requirements, Mr. Fairey developed the now well-known Fairey Patent Flap Gear. This was a hinged trailing edge flap, similar to an aileron, but extending from the wing root to the inner end of the aileron. The effect, of course, was to give a variable camber, and although the thin wing section used in the early biplanes was not capable of giving a very high lift coefficient, the trailing edge flap did raise it considerably and so enabled the machine to carry a reasonable wing loading while still having a very low stalling speed. The gear was first fitted to the Hamble Baby and was a great success. The machine was a three-float seaplane fitted with 110 h.p. Clerget engine. The loaded weight was 1,900 lb. and the wing loading 7.8 lb./sq. ft., with which a maximum speed of 98 m.p.h. was attained.

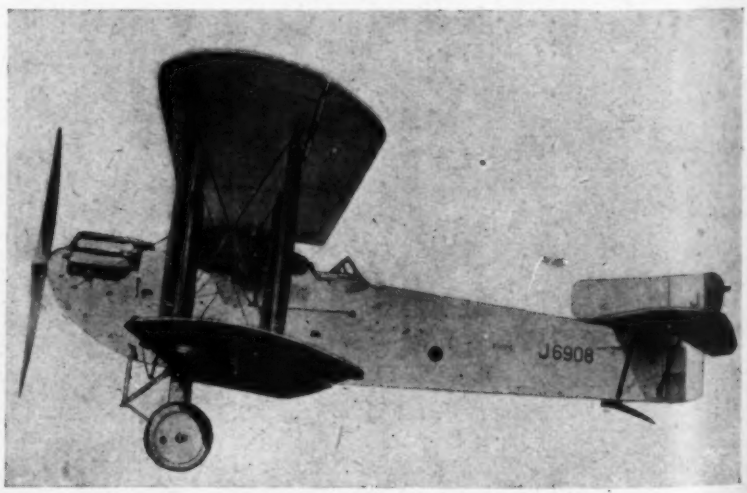
In 1916 the firm received an Admiralty specification for seaplanes of a larger type. Mr. Fairey's interpretation of the specification was a single-engined seaplane, again with three floats, which became known as the Campania. It had a Rolls-Royce engine of 250 h.p. and weighed 5,500 lb. With a wing loading of 8.6 lb./sq. ft. the speed was 90 m.p.h. The name Campania, by the way, was given to the type because the first aircraft was allocated to a parent ship of that name. Many of these machines were built and did good work on patrol in the Great War. The first of them was flown from the Isle of Grain to Scapa Flow by Sqn. Ldr. Maurice Wright, now a director of the company.

It might here be mentioned that during this time Mr. F. Duncanson was in charge of the design section, a position which he held until 1925.

Origin of Series III

In the years to come, the Fairey Series III machines were to become famous, and it is therefore of interest to record that the Series had its beginning in two experimental seaplanes, known respectively as the N.9 and N.10. They were generally similar and were two-seater biplanes, the N.9 having a Rolls-Royce engine of 190 h.p., while the N.10 had a 260 h.p. Sunbeam. The N.9 was designed for ship work and was a small two-seater with unequal-span wings. The N.10 was similar but had wings of equal span. The N.9 weighed 3,820 lb., and had a speed of 90 m.p.h., while the N.10 weighed 4,160 lb. and had a speed of 106 m.p.h.

At the end of 1917 the Fairey Co. produced a landplane which became known as the Fairey III A. It was a reconnaissance biplane with a Sunbeam engine of 260 h.p., and it weighed 3,694 lb. The wing loading was 7.75 lb./sq. ft., and the speed 110 m.p.h. Various types of undercarriage were fitted to this type of machine. First there was the normal

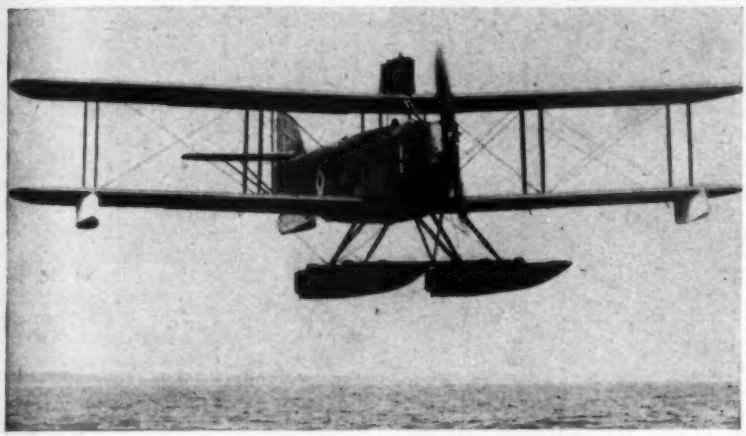


The Fawn (1923) was developed from the Pintail for reconnaissance and day bombing. One was fitted with the first supercharged Napier Lioness.

A REAL FAIREY STORY (Continued)

The Flycatcher (1923) was a deck-landing single-seater with Siddeley Jaguar of 350 h.p. There was also an amphibian version.

The Freemantle (1924), shown below, was a long-distance service type with 650 h.p. R.-R. Condor engine. Fuel was carried in the floats.



land undercarriage, but others had the ski undercarriage for use in the Arctic regions, and yet another variation had a skid undercarriage on which was mounted a hydrovane.

A further expansion of the works became necessary to cope with the large orders, and a new factory, including a large erecting shop was built on the Harlington Aerodrome site in 1918. A temporary shed housed the drawing office. Mr. W. Broadbent, a director of the company, was works manager during this production period and was thus responsible for the manufacture of the early Series III machines. Mr. C. F. Bray, who was then chargehand of the experimental fitting shop, subsequently became chief of the experimental department. After the production of the Hamble Baby, Campania and III As at the works in Clayton Road, this part of the factory was closed down and work was transferred to the site in North Hyde Road.

As a result of the experience gained with the Series III A landplanes and the previous seaplanes, a new type in the III series was designed and became known as the III B. This was a seaplane with 260 h.p. Sunbeam engine and weighed 4,892 lb. The wing loading was 8.6 lb./sq. ft. and the speed was 96 m.p.h. The III C was generally similar to the III A in its design, although, of course, it differed in its undercarriage, which was of the three-float type. In those days the power loadings of aircraft were high and, in order to get the seaplane off the water, it was customary to use flat-bottom floats. While these were excellent for take-off, they were apt to be damaged in landing when the waves hit the flat bottom. To reduce the likelihood of this happening, the Fairey company designed a special type of float undercarriage with shock-absorbing attachment, which greatly reduced the shocks imparted to the floats. This arrangement was successful, and the principle was retained in very many Fairey types subsequently.

Following almost immediately on the III B came the III C. By this time (1918) the Rolls-Royce Eagle VIII of 375 h.p. had become available and was installed in this aircraft. The III C was employed for escort duties as well as for fighting during the Great War. A squadron was used in the North Russian Expeditionary Force in 1919. For his services on this Expedition Flt. Lt. L. M. Hilton, now technical director of the company, was awarded the D.F.C.

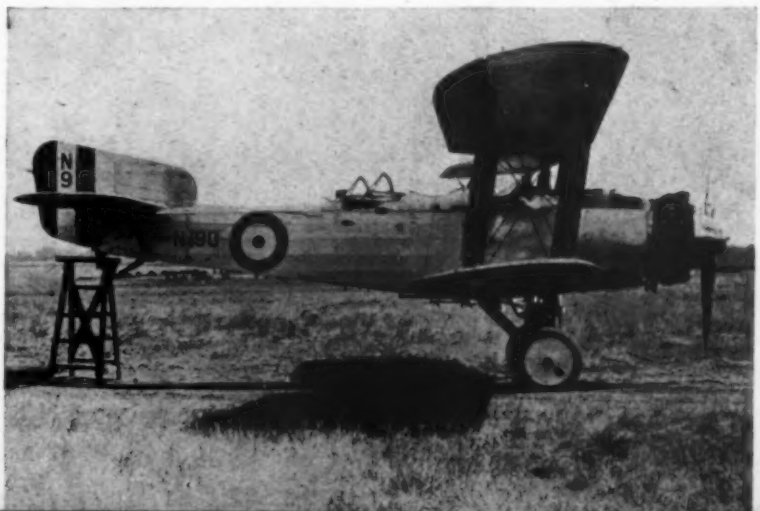
Large Flying Boats

Towards the end of 1918 the Fairey Company was entrusted by the Air Ministry with the task of designing and producing a flying boat. Two of these were laid down and were known as the Atalanta and the Titania respectively. They were four-engined boats, and were the largest successful flying boats in the world at that time. They weighed 32,000 lb. loaded and carried a wing loading of 11.5 lb./sq. ft. The speed was 100 m.p.h., and the power plant was four Rolls-Royce Condor engines of 600 h.p. each.

The construction of these flying boats was under the direction of Mr. A. C. Barlow and Mr. W. Walmsley. The former is now chief engineer of the company and the latter is works manager at Hayes.

While the gradual evolution of the Series III was proceeding, work was begun on what was to be the first post-war design of the Fairey Company. This was for a two-seater ship plane amphibian which later became known as the Pintail. The engine was a Napier Lion of 470 h.p. The speed was 125 m.p.h., which was high for a seaplane of that relatively low power.

The Pintail incorporated several new



The Ferret (1927) was the first all-metal fabric-covered Fairey aeroplane. It was a G.P. type, and was fitted with Bristol Jupiter and Siddeley Jaguar engines.

A REAL FAIR

One of the most versatile of all Fairey aircraft was the III F. It was supplied as a G.P. landplane and as a Fleet Air Arm seaplane. Different engines were fitted, such as Napier Lion, Bristol Jupiter, Siddeley Jaguar, and the French Lorraine. Production began in 1926 and continued for many years.

"Flight" photograph.

features. The tail unit was rather unorthodox in that there was no vertical tail surface above the tailplane. Below the tailplane was a pair of small fins, one on each side, and the rudder was mounted entirely below the tailplane. The object, of course, was to give the rear gunner of the machine an entirely unrestricted field of fire over the rearward hemisphere.

Another interesting feature was the rear portion of the fuselage, which was of considerable depth and unique in its construction, being built in three entirely separate sections: a nose-piece carrying the engine, a centre section carrying the wings and cockpit controls, and a tail portion which ran aft of the wings to the tailplane.

A new float seaplane undercarriage was incorporated; this was a further improvement on the type previously employed on series III aircraft. This arrangement consisted of special long-type boat-built floats with a single step incorporated in each float. A standard aero wheel was fitted aft of the step for deck landing. The tail skid projected rearwards and downwards from the tail float. In addition to Pintails supplied to the British Government, a number were supplied to Japan.

The Famous III D

During the following year (1921) appeared a type of the III series which was to become by far the most popular. This was known as the III D. It was produced both as a three-float seaplane and as an ordinary landplane. The standard power plant was the Napier Lion of 470 h.p. Variations of the type were, however, fitted with the Rolls-Royce Eagle and with the French Lorraine engine of 450 h.p.

The III D was, in every sense of the term, a general-purpose aircraft, and its duties included bombing, photography, reconnaissance, gunnery spotting, etc. The fact that the machine could be converted in a very short time from seaplane to landplane and vice versa was an added point in its favour. In addition, it could be fitted with a ski chassis for use on ice or snow. The land undercarriage had a specially robust shock-absorbing arrangement in which use was made for the first time of legs of the oleo-pneumatic type. With a Napier Lion the III D had a weight of 5,050 lb. and a wing loading of 10.6 lb./sq. ft. The speed was 126 m.p.h.

A special version of the III D was built for a record flight across the South Atlantic. This had a Rolls-Royce Eagle VIII of 365 h.p., so that, naturally, the speed was somewhat slower, *i.e.*, 116 m.p.h. On a machine of this type Cdr. Saccadura-Cabral, of the Portuguese Navy, made a crossing of the South Atlantic in 1922. The III D had many other achievements to its credit, including a flight round Australia, the Singapore survey, and the R.A.F. flight across Africa as an aeroplane and then Cairo-Cape Town and back to Cairo and on to England as a seaplane. The distance covered was 14,000 miles, and there were no major repairs or replacements of any sort.

The III D seaplane was also fitted out as an ambulance for operation in South America, and the military type was supplied in considerable numbers to Australia, Holland, Trinidad and British Columbia. Portugal had both the landplane and the seaplane versions. Some of these aircraft were on active service in various parts of the world for ten or twelve years, which is probably something of a record. It was in 1922 that the first set of all-metal wings was designed and built for the type III D.

When Capt. Norman Macmillan joined the company in 1925 as chief test pilot, Vincent Nicholl took to administrative work again and became deputy managing director to Mr. Fairey. He remained in that office until his death in 1927.

In 1923 the company was the first aircraft firm in the country to be approved for its own inspection, with Mr. H. T. Woodsmith as chief inspector. In that year was produced the Fairey Fawn, which structurally and aerodynamically was a further development of the Pintail. Operationally, however, it was different in that it was a three-seater Army Reconnaissance aircraft which could be readily converted to a day bomber. The standard type had a Napier Lion engine of 480 h.p. One machine of this type was fitted with a Napier supercharged Lioness, which was the first of this type to be flight tested.

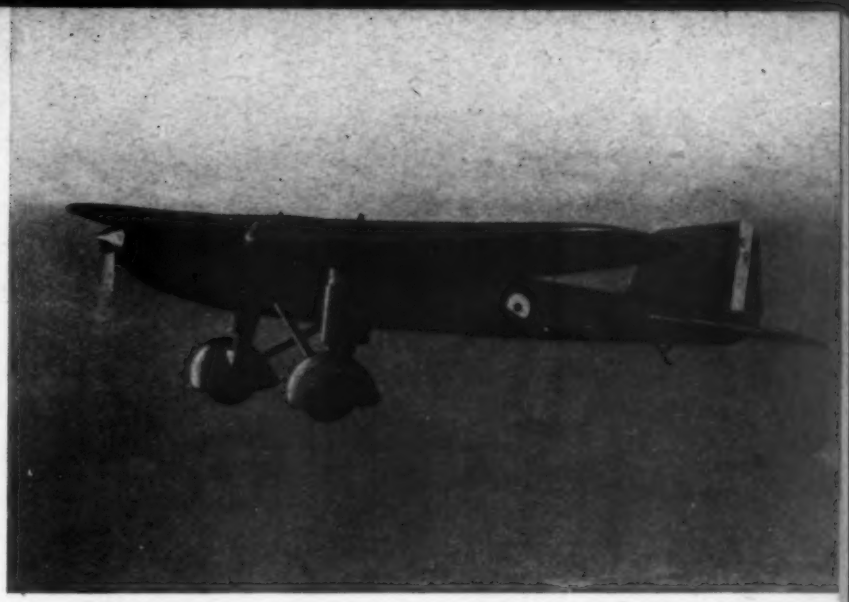
For Deck-landing

While the Fawn was in production the Fairey Co. produced an experimental single-seater deck-landing biplane fitted with the Armstrong Siddeley Jaguar engine of 350 h.p. The Flycatcher was produced as a landplane, a float seaplane, and as a float amphibian. As a landplane it weighed 3,028 lb., had a wing loading of 10.3 lb./sq. ft., and a speed of 137 m.p.h.

The amphibian and seaplane Fly-

A 1928 production was the Fleetwing with Rolls-Royce F.XII engine. It was a two-seater fleet fighter, and was convertible into a landplane.

FAIREY HISTORY (Continued)



5,340 miles in 57 hr. 25 min. The Fairey long-range monoplane (Lion) established this non-stop flight record in 1933, piloted by Gayford and Nicholetts. The first machine was built in 1929.

"Flight" photograph.

catchers were fitted with the first Fairey special long-type, boat-built floats. The floats were extended aft in order to give sufficient buoyancy to do away with the float which had in previous seaplanes been fitted underneath the tail. A further improvement of the amphibian was shock-absorbing gear which was provided for the wheels mounted just aft of the step of the floats. The Fairey Flycatcher was one of the first aircraft to be fitted with catapult spools to enable the machine to be launched by this method. It also had arrester gear in the form of deck hooks mounted on the axle of the undercarriage.

Oversea Reconnaissance

In 1924 the Fairey Co. produced an experimental seaplane known as the Freemantle. This was designed for long-distance service duties and had a Rolls-Royce Condor engine of 650 h.p.. It weighed 12,550 lb. The Freemantle was the largest single-engine float seaplane in the world which had been built up to that time. The machine had several interesting features, among which may be mentioned that the fuel was carried in tanks in the floats. This permitted the cabin in the fuselage to be fitted with heating apparatus and made comfortable as quarters for the crew of five which was normally carried.

Nineteen twenty-four was a notable year in the history of the Fairey Aviation Co. In that year Major T. M. Barlow, who held an important position as factory inspector at the Home Office before the Great War and was for many years chief technical officer at Martlesham Heath, joined the company as chief engineer. He reorganised the design and technical departments, and some seventy draughtsmen and about twenty technicians were employed to deal with the production of the Flycatcher and III D aircraft. It was in that year, too, that the Fairey Co. was officially approved by the Air Ministry for all stress calculations.

Among those who joined the Fairey Co. in 1924 may be mentioned Mr. A. G. Hazell, who joined as assistant secretary. In 1927 he became secretary on the death of Mr. Amos.

Mr. M. J. O. Lobelle succeeded Mr. Duncanson as head of the design section, and Mr. P. A. Ralli, who had previously done a great deal of work on the III D and Flycatcher, was made head of the technical department. At this time also Mr. R. McNeillie was in charge of the jig and tool design office at Hayes, and Mr. H. L. Pearce was chargehand of the experimental erecting shop. Mr. C. R. Macmullin joined the company the same year as assistant test pilot to Capt. Macmillan.

It was at about this time (1925) that Mr. Fairey began strenuously to oppose the prevailing fashion of carrying all sorts of service equipment, etc., in places exposed to the air. He realised that by doing this, although service requirements might be met, the performance of aircraft suffered badly. As he could not persuade the authorities to alter their specifications, he decided to build a machine entirely to his own ideas. Not that he proposed to abandon any of the military load which earlier types had carried, but he did intend to stow the equipment in such a way as to make the machine as clean as it was possible to make it. At that time he obtained the British rights in the Curtiss C.12 engine, an American water-cooled twelve-cylinder

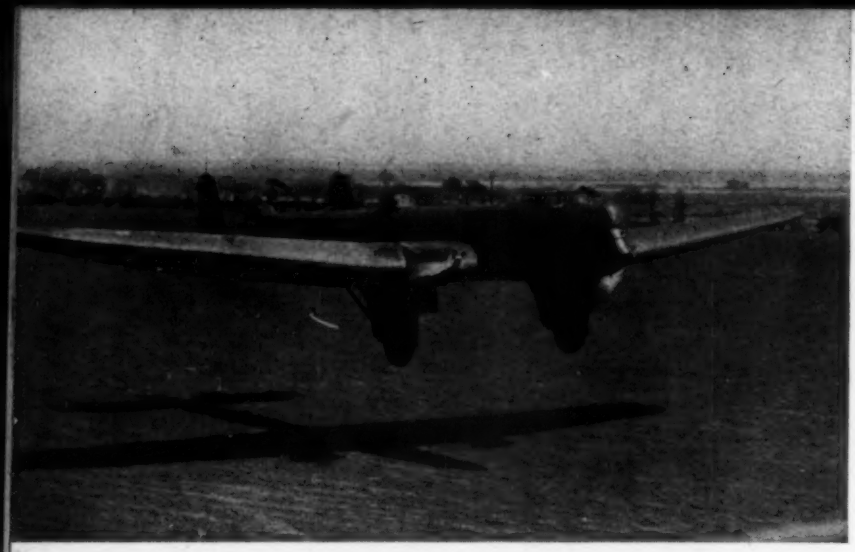
The all-metal version of the Firefly was known as the Firefly II. It appeared in 1929 and had a Kestrel engine of 550 h.p. In the picture below it is being piloted by Flt. Lt. Staniland.

"Flight" photograph.

The original Fox with Curtiss engine appeared in 1929. The Mark II was started the same year, and was of all-metal construction. The engine was a R.-R. Kestrel of 475 h.p.

"Flight" photograph.

A REAL FAIR



The first all-metal low-wing cantilever monoplane to go into service in the R.A.F. was the Fairey Hendon (1930), which had two Rolls-Royce Kestrel engines of 478 h.p. each. There were gun positions in nose and stern.

"Flight" photograph.

V-engine of 460 h.p. The Fairey engine was called the Felix.

The machine built around the Felix engine became known as the Fairey Fox Mark I. It was a two-seater day bomber and it can be said to have revolutionised the standard of design for military aircraft of that time. That this is no exaggeration will be realised when it is pointed out that the performance of the Fox added something like 50 m.p.h. to the speed of current types of medium bombers whilst carrying the same useful load and it was not surprising that, as a result of tests at Martlesham Heath, the Fairey Co. was given a contract to supply a squadron of these machines. The designers were given a free hand and there is not the slightest doubt that the Fairey Fox set a new fashion in design and established new standards for comparison.

With 460 h.p. Felix engine the Fox Mark I had a loaded weight of 4,018 lb., a wing loading of 12.8 lb./sq. ft., and a top speed of 158 m.p.h.

At the same time as the Fox was being produced, the Fairey design staff turned out a single-seater fighter of very similar lines and, of course, fitted with the 460 h.p. Felix engine. This machine had a maximum speed of 188 m.p.h. at a loaded weight of 3,616 lb. and a wing loading of 13.3 lb./sq. ft. Like the Fox the Firefly was produced as a private venture. Both the Fox and the Firefly were subsequently manufactured in Belgium at Gosselies, where in the meantime Mr. Fairey had established a branch company.

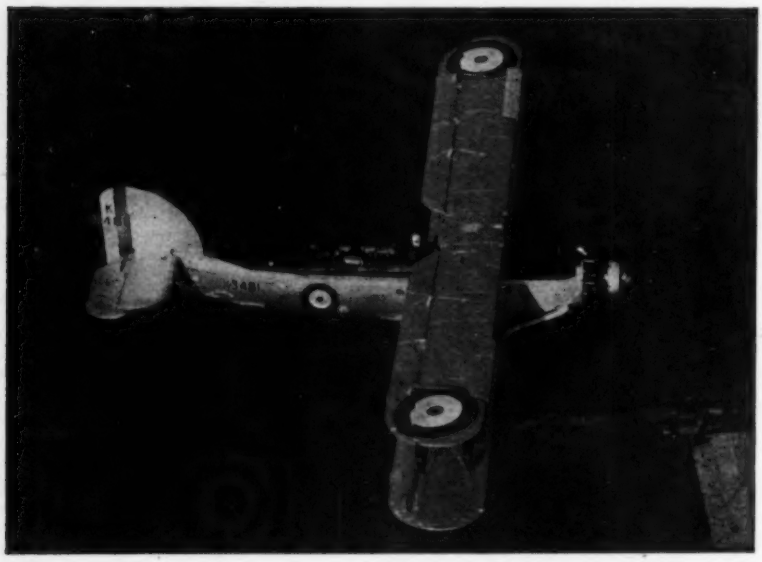
During 1926 large orders were received for boat-built floats for the III D. and the Flycatcher types. It became necessary to extend the factory by adding two more bays, and a large erecting shop was built to accommodate the assembly of III D and Flycatcher aircraft. The experimental department was also extended and two experimental machines were put in hand, known as the Flycatcher II and the Ferret respectively.

Air-cooled Speed

Although it was given the name Flycatcher II, the experimental machine actually resembled more the Firefly type. It was a single-seater fighter and had the clean lines of the first Firefly, but was fitted with a Bristol aircooled supercharged Mercury 520 h.p. radial engine. A special form of cowling was introduced for this aircraft and showed that even with a radial it was possible to obtain a very clean line. For a loaded weight of 3,150 lb. and a wing loading of 11.4 lb./sq. ft., the speed was 137 m.p.h.

The Ferret was a two-seater General Purpose biplane fitted with Armstrong Siddeley Jaguar engine. It was the first all-metal fabric covered aircraft built by the Fairey Co. and was designed to give a great measure of interchangeability.

In the meantime the Series III had by no means reached the limit of its possibilities. During the period 1926-27 a further machine was developed in the series, which became known as



The S.9/30 (Kestrel), shown on the left, was an experimental fleet spotter. Apart from the unorthodox single-float arrangement, which was used much in America but never became popular in this country, the machine was interesting because of its construction, which had a primary structure of stainless steel.

The upper picture shows the Gordon G.P. type, which was also produced as a seaplane under the name Seal. Both had Siddeley Panther engines of 525 h.p. They were a development of the III F. The S.9/30 appeared in 1931, and the Seal and Gordon in 1932.

ORY (Continued)

The G.4/31 specification was for a general purpose machine which could operate as a bomber from small rough aerodromes, and as a torpedo carrier. This machine had a Siddeley Tiger engine of 750 h.p.

the III F. It was available with a variety of power plants and in both landplane and seaplane form. In addition, it was used as a General Purpose landplane, as a Fleet Air Arm landplane, as a Fleet Air Arm seaplane and the loaded weights ranged from 5,120 lb. to 6,543 lb., while wing loadings varied from 11.5 lb./sq. ft. to as much as 14.72 lb./sq. ft. The speeds varied from 124 m.p.h. to 150 m.p.h. according to type.

Among the types of engine with which the III F was fitted may be mentioned the Napier Lion XA, the Lion V, the Jupiter VIII, the Siddeley Jaguar and the Lorraine. The III F was at first of composite construction, but later versions were of all-metal construction.

Large Exports

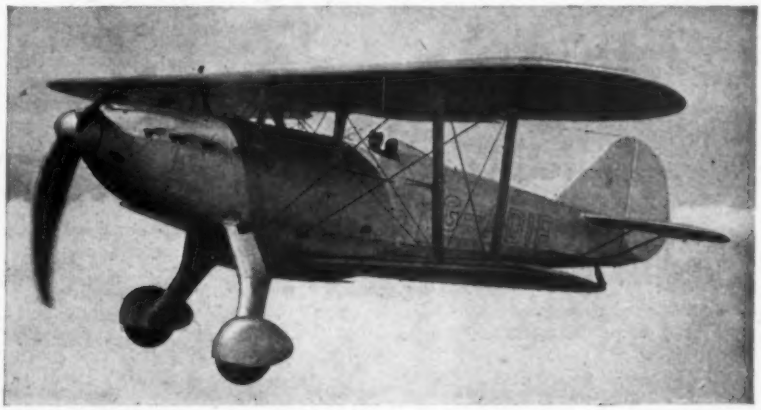
A very important export business was done with the III F. In the face of international competition, the Fairey Aviation Co. succeeded in obtaining an order for a number of them for the Argentine Navy. Orders for the same type were also received from the Chilean Government, and among other countries and Dominions which ordered Fairey III F aircraft may be mentioned Greece, Russia, China, New Zealand, India and the Irish Free State.

The III F was used for many interesting purposes, and here it is worth mentioning that one of them carried on its top plane a small glider which could be released by the pilot while in flight. After it had been released in the air, the glider was used as a target for naval gunnery practice. It will be recollected that aircraft of the III D type had carried out extensive flights across Africa. A similar flight was carried out by four III Fs, starting from Heliopolis Aerodrome (Cairo) and going via Khartoum and Pretoria to Cape Town. On returning to Cairo by the same route, the four III Fs had covered a distance of 11,000 miles each without any trouble worth mentioning. The flight had also kept to the prearranged schedule throughout.

The next machine to be designed was a two-seater Fleet fighter shipplane known as the Fleetwing. In its original form the Fleetwing was a seaplane, but it had been designed to be readily convertible into a landplane by substituting a wheel undercarriage for the floats. In the latter form it was used for deck landing. As a seaplane the Fleetwing was interesting in that it was the first Fairey machine to be fitted with the latest type of Fairey all-metal floats. The new floats were of the long type with steps and had a pronounced V bottom which gave them excellent shock absorbing qualities when alighting and taking off in rough seas.

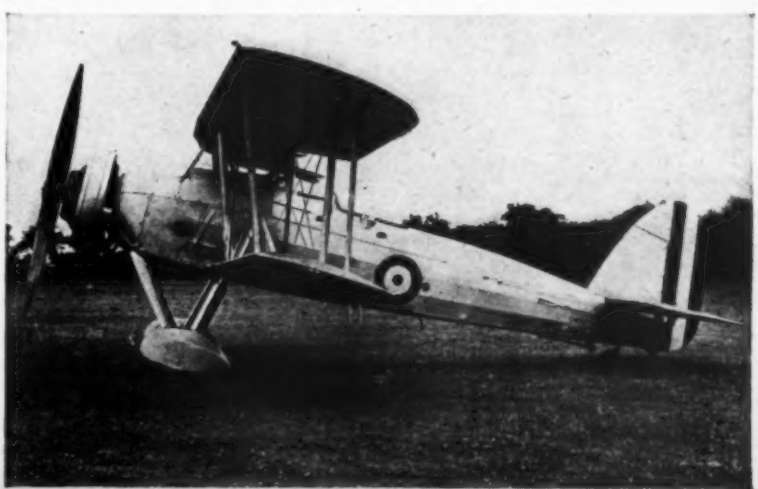
Concurrently with the design of the Fleetwing, the Fairey Co. turned its attention to the monoplane type, which was showing great possibilities. In the early part of 1928 work was commenced on the first cantilever monoplane to be built in this country. This machine, known as the long-range monoplane, was designed for an attack on the world's long-distance record. The type of machine built had a Napier Lion XI A engine of 570 h.p. Its gross weight was 17,500 lb. and the wing loading reached the surprisingly high figure (for that time) of 20.7 lb./sq. ft. The speed was about 110 m.p.h., and it will be realised that in view of the intention to attack the world's long-distance record the monoplane was designed for long range but not for very high cruising speed.

The first attempt on the world's long-distance record, made in April, 1929, was not successful, although the machine covered a distance of 4,130 miles in 50¼ hours, flying from Cranwell to Karachi. Very strong head winds reduced the average speed to 65 m.p.h., and it was necessary to



"Flight" photograph.

One of the cleanest single-seater fighter biplanes ever produced was the Fantome of 1934. It had a Hispano engine of 910 h.p. and did 252 m.p.h.



The T.S.R.II (Pegasus III M, 750 h.p.) was produced in 1934, and was the forerunner of the Swordfish. Note the Townend cowling ring.

"Flight" photograph.

By 1935 the T.S.R.II had developed into the Swordfish (750 h.p. Pegasus). Produced both as a landplane and as a floatplane, the machine has speeds of 154 m.p.h. and 144 m.p.h. respectively. It distinguished itself in the Taranto action a few months ago and has been mentioned several times since.

land at Karachi as the machine had run out of fuel.

A second machine was constructed in 1930. This carried rather more fuel than had the original machine and towards the end of 1931 it made a preliminary non-stop flight from Cranwell to Cairo. The actual record flight was made in February, 1933, when Sqn. Ldr. Gayford and Flt. Lt. Nicholetts established the world's long-distance record of 5,340 miles from Cranwell to Walvis Bay, South Africa. The time taken for this flight was 57 hours 25 minutes. The long-range monoplane was interesting in many ways. The wing had pyramid bracing.

All-metal Design

Encouraged by the success attained in the all-metal designs of the Ferret and Fleetwing, the Fairey Co. decided further to improve the Fox and Firefly on similar lines, and a new all-metal design was begun in 1929 for each of these types. The structure of these two aircraft was of metal throughout, the fuselage being of steel tube construction, while the wings had main spars constructed of a high-tensile steel strip drawn to double-lobe section riveted to webs which were stabilised by angle plates. Not only the primary structure, but the secondary lightly-stressed structure was of metal also.

The aerodynamic design was also further improved and cleaned up, and when fitted with the Rolls-Royce Kestrel II engine of 474 h.p. the Fox Mark II had a top speed of 190 m.p.h.

The Firefly II with a Kestrel II S engine of 550 h.p. had a top speed of 215 m.p.h.

Foxes and Fireflies

Many Fox IIs were supplied to Belgium for the re-equipment of certain squadrons of the Belgian Air Force. The machine was ordered in the face of keen foreign competition of well-known Continental designers. An order was also received from Peru, and this was secured in competition with French and American aircraft constructors. A certain number were also supplied to Switzerland. The Firefly II was demonstrated at the request of the Belgian authorities and was kept there. Pilots' reports were very favourable and the Belgian Government decided to purchase several of these machines as standard equipment for the Belgian Air Force. A Firefly II was also supplied to Russia.

Following Mr. Ralli's death in 1930, Mr. D. L. Hollis Williams, who had been mainly responsible for the design of the long-range monoplane, succeeded Mr. Ralli as head of the technical department. Since joining the company in 1916 Mr. Ralli had done considerable valuable original research work on strength and performance of high-performance aircraft. His airscrew design and mathematical analyses resulted in a solution of the problems of providing metal airscrews for high-powered racing aircraft. This work did much to enable this country to win the Schneider Trophy back from Italy in 1927. He was again successful in his airscrew designs for the 1929 Schneider Contest. Mr. G. E. Toms, now deputy works manager, was in charge of the airscrew shop on the Fairey metal airscrews at that time.

In this year also Mr. C. R. Macmullin succeeded Capt. Macmillan as chief test pilot, with Flt. Lt. Staniland and Mr. H. T. Andrews as assistants. In the following year Mr. Macmullin, together with Mr. Kenneth Wright, inspector in charge at Gosselies, Belgium, was involved in an accident in which both were killed. Flt. Lt. Staniland took over chief test pilot's duties, and Mr. S. H. G. Trower joined the pilots at the Great West aerodrome. In 1935 Mr. Trower was killed in an air crash, and in the same year Mr. D. M. Menzies joined the company as assistant test pilot. In 1936, when the expansion programme developed, Mr. Menzies went to Stockport and was joined by Mr. Moseley as his assistant. Mr. F. H. Dixon and Mr. V. G. Wilson joined Flt. Lt. Staniland at the Great West aerodrome. In 1930 was produced the Firefly III, which was a single-seater fighter ship-plane. It was produced both as a seaplane and as a landplane, and in the former variety it had the surprisingly high speed of 200 m.p.h. when fitted with the Kestrel II S of 550 h.p. For a seaplane this was, of course, extremely good. The Firefly III had provision for catapulting, and was fitted with arrester gear for deck landing.

Following the success of the long-range monoplane, the Fairey Co. decided to apply the experience gained to the design of an all-metal military monoplane. This became known as the Fairey Hendon and was fitted with two Rolls-Royce Kestrel III S engines of 478 h.p. each. This machine was designed to carry its bomb load stowed internally in the wings and was the first of its class to go into service with the Royal Air Force. A variation of it was fitted with two Bristol Jupiter XF engines of 596 h.p..

During 1930 a new type of experimental fleet-spotter reconnaissance aircraft was designed. This was known as the S.9/30 and was built in 1931.

The wheel undercarriage was interesting as being of the so-called divided type, that is to say, each wheel was carried on a tripod of struts and there was no cross axle. The seaplane version was unorthodox in having a single central main float.

End of Series III

So successful had been the III F, that in 1932 the Fairey Aviation Co. decided to produce two modifications of it. These became known as the Gordon and the Seal respectively. The Gordon was a General Purpose machine and was therefore a two-seater, while the Seal was a Fleet Air Arm type and carried in addition a wireless operator. Both types were produced as landplanes and seaplanes, and the engine in all cases was an Armstrong Siddeley Panther of 525 h.p.

Both types were widely adopted for the Royal Air Force and Fleet Air Arm, and in addition several foreign countries bought them, including the Argentine, Brazil, Peru, and Latvia.

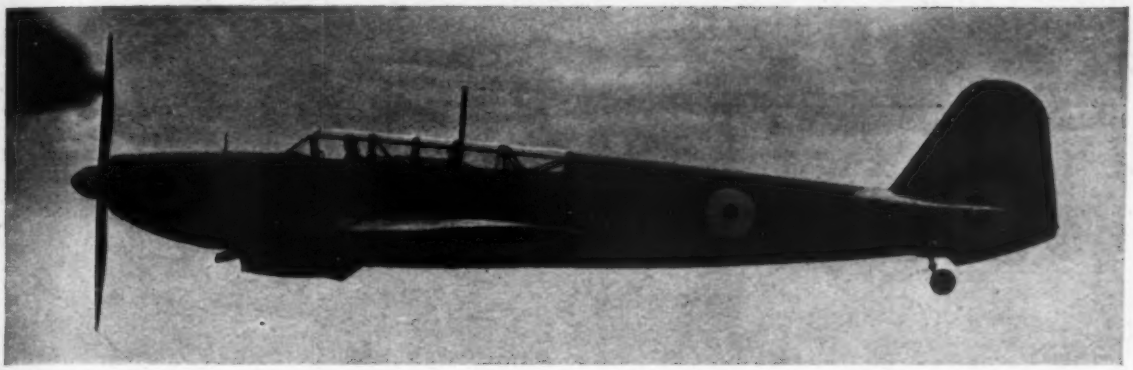
A REAL FAIREY STORY (Continued)

A REAL FAIREY STORY
(Continued)

Real modernity was first introduced in the Fairey Battle of 1935. The clean lines give it a speed of 257 m.p.h. under the urge of a 980 h.p. R.-R. Merlin engine.

(Below) The P.4/34 light day bomber (Merlin) appeared in 1937. It had a speed of 281 m.p.h. and later developed into the Fulmar.

"Flight" photograph.



Provision was made for carrying extra fuel tanks. These increased the maximum still-air range to the impressive figure of 2,300 miles.

Fox Variations

The year 1933 was chiefly remarkable for the production of no fewer than four variations of the original Fox. These were the Mark III, which had a 360 h.p. Armstrong Siddeley Serval engine, the Mark IV, which was a reconnaissance seaplane with 635 h.p. Kestrel II medium supercharged engine, the Fox V, a single-seater version built by the Fairey works in Belgium under the name Kangaroo, and the Mark VI, a two-seater fighter with Hispano engine and a formidable armament comprising no fewer than five guns, *i.e.*, four machine-guns, one on each side of the fuselage and one on each of the upper planes, plus a cannon installed to fire through the airscrew hub in the Hispano-Suiza engine. The data relating to these four variations of the Fox are given below:—

Type	Engine	Weight	Load per sq. ft.	Speed
		lb.	lb.	m.p.h.
Fox III ...	Serval 360 h.p.	4,296	11.6	138
Fox IV ...	Kestrel II MS 635 h.p. ...	5,590	15.12	158
Fox V ...	Kestrel II S 550 h.p. ...	4,340	11.72	193
Fox VI ...	Hispano 850 h.p. ...	5,130	14.15	200

Two types were designed and produced in 1934, the General Purpose biplane designed to specification G.4/31, and the single-seater fighter called the Fantome.

The G.4/31 was designed to operate either as a bomber from small rough aerodromes, or as a torpedo carrier from aerodromes of average size in the tropics. The engine was an Armstrong Siddeley Tiger IV of 750 h.p., and the gross weight was 8,790 lb. By way of defensive armament the G.4/31 carried two guns, one in the rear cockpit mounted on the standard Fairey high-speed gun mounting, and the other firing through the airscrew disc.

The Fantome was probably the cleanest single-seater biplane fighter the Fairey Aviation Co. produced. Apart from its generally clean aerodynamic design, drag was further reduced by fitting the wheels on cantilever struts and fairing them in with "spats." The armament consisted of one 20 mm. cannon which fired through the airscrew hub, and four Browning guns, two of which were fitted in the fuselage and fired through the airscrew disc, while the other two were mounted in the lower wing root just outside the airscrew disc. Loading and firing control was by compressed air. With a Hispano-Suiza engine of 910 h.p. the Fantome weighed 4,500 lb., had a wing loading of 15.4 lb./sq. ft., and developed a maximum speed of 252 m.p.h.

Some changes of personnel occurred during 1934. Mr. R. T. Youngman succeeded Mr. D. L. Hollis Williams as head of the technical department, with Mr. A. C. Brown and Mr. C. F. Hodson as assistants. Mr. C. C. Vinson, now a director, succeeded Mr. Hazell as secretary on the latter's death.

T.S.R.

In 1934 was produced an experimental Fleet Air Arm aircraft which was later to become known as the

The little Seafox (1936) with Napier Rapier engine of 395 h.p. took a distinguished part in the *Graf Spee* action.

"Flight" photograph.

The duties of the Albacore (1939) include dive bombing, reconnaissance and torpedo carrying and spotting. The engine is a Bristol Taurus of 1,065 h.p.

Swordfish. This type of machine took a distinguished part in the Taranto action some months ago. These aircraft were produced to combine three duties, viz., torpedo, spotting and reconnaissance, which it had hitherto not been considered possible to combine, the various duties being obtained by separate types. At the time the specification appeared to be an extremely difficult one, but by intensive investigations the full service requirements called for were successfully met. The success of the Swordfish has amply justified the judgment of those who laid down the policy underlying the evolution of this type.

The Swordfish had a Pegasus III M engine of 750 h.p. encircled by a Townend ring. The machine, a three-seater, had mainplanes of equal span but unequal chord. A somewhat unusual feature was that only the top plane had a dihedral angle. It was equipped with a full range of fittings for Fleet Air Arm duties, including catapult spools and deck arresting gear.

The weight and consequently the wing loading and speed varied somewhat according to the purpose for which the machine was equipped. Details are given in the following table:—

	Ship		Seaplane	
	Recon-naissance	Plane Bomber	Recon-naissance	Bomber
	lb.	lb.	lb.	lb.
Weight ...	7,340	8,250	7,760	8,670
Load per sq. ft.	13.5	15.2	14.3	16.0
	m.p.h.	m.p.h.	m.p.h.	m.p.h.
Speed... ...	154	149	144	138

The pilot's cockpit was located behind the top centre section and his seat was so arranged that it could be raised or lowered during flight, so as to enable him to have a good view forward for landing, taking-off, etc. Behind the pilot's cockpit was the centre cockpit for the observer. Provision was also made for a prone bombing position under the pilot's floor. The aft cockpit was, as is customary in Fleet Air Arm aircraft, used by the wireless operator and rear gunner.

The T.S.R. II or Swordfish represented a great advance on seaplane construction. This was made possible by the long experience which the Fairey Co. had gained on the earlier Series III and III F types. A feature of great practical importance was the absolute interchangeability of components and the ease of maintenance and repair. It was found on actual service that the repair scheme provided for this aircraft enabled almost any damaged part to be replaced very quickly without upsetting the alignment of the structure.

During this time the drawing office was rearranged for the production of the Swordfish, with Mr. C. G. J. Dunsford as chief draughtsman.

Super Efficiency

While the T.S.R. II or Swordfish was in production, the design office was looking ahead to the next type. The long-range monoplane had given remarkable results from the point of view of aerodynamic efficiency, and it was decided that the time had come for a long step forward with a type which should incorporate every bit of modern knowledge, not only aerodynamic but structural. It was realised that although the long-range monoplane had provided valuable experience, further progress would demand extensive research, and the experimental department was put to work on tests of all manner of materials so as to discover those which would give the most efficient results in the design contemplated. Many grades of light alloy were investigated, and when the best had been selected they were built into structural units, which were mechanically tested for torsional strength and rigidity.

The result of this extensive experimental work was the low-wing monoplane which afterwards became famous as the Fairey Battle. In 1935 a tender was submitted to the Air Ministry, and it was not long before production was in full swing. Apart from designing for aerodynamic efficiency, the designers had ease of production well in mind, with the result that when the so-called "shadow-factories" came into existence, the Battle became one of the types chosen for large-scale production.

A REAL FAIREY STORY (Continued)

Space does not permit of a detailed description of the Battle, but it may be recalled that the structure is of the all-metal, stressed-skin type. The wing has two main spars, the skin between them being stiffened by Z-section stringers running spanwise. The fuselage has oval-section hoop frames, and instead of longitudinal stringers one edge of each "plank" of the skin covering is lipped for stiffness. Thus a single line of rivets suffices.

Internal Bombs

Classed as a medium bomber, the Battle carries a defensive armament of fixed and movable machine guns, the latter on a Fairey special rotating cone mounting. The bombs are carried internally in the wing in special cells, on hydraulically retracted racks. With the Merlin I engine the Battle has a loaded weight of 10,898 lb., a wing loading of 26 lb./sq. ft., and a top speed of 257 m.p.h. Apart from its original function as a bomber, the Battle has also been used extensively as a trainer.

When the Swordfish and Battle were well under way, the Fairey designers turned their attention to the production of a light reconnaissance biplane for the Fleet Air Arm. The type was to be used primarily for operation from cruisers, and thus had to be capable of being launched from the smaller type of naval catapult. The type, a twin-float biplane, became known as the Seafox. It had a Napier-Halford Rapier VI engine of 395 b.h.p., carried a crew of two, and weighed 5,410 lb. loaded. The wing loading was 12.46 lb./sq. ft., and the speed 125 m.p.h.

It will be recalled that one of the Seafox seaplanes did excellent work in the *Graf Spee* action off the South American coast. In fact, without the information which the seaplane provided the action might have taken a different course.

A Dive Bomber

A monoplane, generally similar to but somewhat smaller than the Battle, followed in 1937. This was designed to Air Ministry specification P.4/34. This machine had a Merlin engine of 1,050 b.h.p., and its loaded weight was less than that of the Battle, viz., 8,680 lb. The wing loading was 25.1 lb./sq. ft., and the top speed 281 m.p.h. In addition to its general character as a light bomber, the P.4/34 was fitted with air brakes for dive bombing.

The P.4/34 passed its type tests in 1937, but the Air Ministry decided not to proceed with the class of aircraft for which the specification was originally drawn up, and subsequently the

A REAL FAIREY STORY
(Continued)

The shape of things to come. The model (below) is of the Fairey F.C.1 four-engined commercial monoplane (1,075 h.p. Taurus) under development when war broke out.

The Fulmar (above) is an eight-gun fleet fighter version of the P.4/34, and has a Merlin engine of 1,060 h.p.

Fairey Company put the type forward for conversion into a Fleet Air Arm two-seater fighter. The suggestion was received favourably, and work on conversion was put in hand. It might be thought a relatively simple matter to make the necessary changes. Actually, that was far from being the case For one thing, wing-folding arrangements had to be incorporated, and there were a good many other modifications. In the end the resulting conversion was virtually a different aeroplane, and has now gone into service in the Fleet Air Arm as the Fairey Fulmar. Details of performance may not be published, but the Fulmar is obviously far and away the fastest two-seater the Fleet Air Arm has ever possessed. It has been stated that the armament includes eight wing guns, so it is evident that in the Fulmar the Fleet Air Arm has not only performance, but enormous firing power.

The Last Biplane

During the development of the P.4/34 the Fairey company produced for the Fleet Air Arm a dive bomber, reconnaissance, spotter and torpedo plane known as the Albacore. The machine operates primarily as a ship plane from aircraft carriers, but a float undercarriage may be fitted and the machine used as a seaplane. The Albacore is a three-seater, carrying pilot, observer, and wireless operator. It has a Bristol Taurus II engine of 1,065 b.h.p. Hydraulically operated diving flaps are fitted to the lower planes.

Normally the armament comprises two machine guns, and the bombs, which are carried in three main and three light racks. As an alternative to the bomb load a torpedo can be carried on detachable crutches under the fuselage. Both the Albacore and the Fulmar have already given excellent service in the present conflict.

Pressure Cabin

In spite of pre-occupation with military aircraft, the Fairey Aviation Company found time, before the war, to examine the prospects of commercial aviation. In conformity with the firm's policy of taking a long view, it was decided to concentrate on the type of aircraft which would be wanted in several years' time rather than on one to meet present requirements. The Fairey F.C.1 was the result, and in 1938 an order for fourteen of these commercial aircraft was received. Much research and experimental work was done before the project was unavoidably shelved by the outbreak of war, and one may reasonably expect that the Fairey company will keep it up to date, so that when we are at peace once more the production of a modernised version of the F.C.1 will be forthcoming with a minimum of delay.

In the meantime it is of interest to record here that the F.C.1 was to be a four-engined monoplane with tricycle undercarriage, pressure cabin, and "all modern conveniences." The Fairey technicians, led by Mr. Youngman, evolved special retractable wing flaps for the F.C.1. These were of a type which would give low drag and fairly high lift for the take-off and high drag and ultra-high lift for the landing. A separate drawing office under Mr. E. C. Garrard was arranged for the design of the machine.

The F.C.1 was designed for a gross weight of 42,000 lb., and with four Bristol Taurus engines of 1,075 b.h.p. each the estimated maximum speed was 275 m.p.h. It was calculated that the range in still air would be 1,700 miles, cruising at 205 m.p.h. on 50 per cent. of the maximum power available. The cruising altitude was to be 13,000 ft. For this range the estimated pay load was 4,500 lb. If the range were reduced to 500 miles, the pay load grew to 9,500 lb.

Last year Mr. H. E. Chaplin, with Mr. F. Bolton as assistant, was appointed head of the design department. Sqn. Ldr. H. G. Sawyer, who joined the company in 1937, is now assistant to Flt. Lt. Hilton, Technical director.

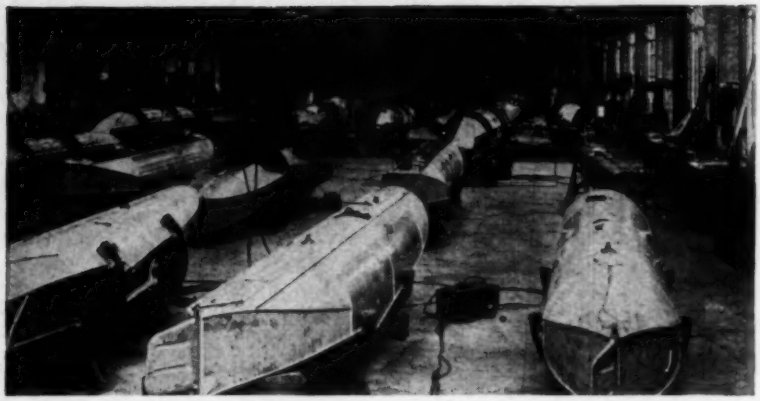
That the Fulmar does not represent the end of the Fairey series will be obvious. So far no hint has leaked out concerning later types, but that there *are* later types may be taken for granted. A firm which has taken as prominent a part in the development of British aviation as has the Fairey Aviation Co., Ltd., is scarcely likely to rest on its laurels at a time when all the best brains in the country are needed. What form the new types will take time alone can tell. That they will worthily uphold a reputation which is world-wide is a foregone conclusion. When the time comes, and it is once more possible to write freely, *Flight* will not fail to record the Fairey history of the war period.

In the meantime it is of interest to recall briefly some of the activities of the firm, other than those relating directly to the succession of aircraft types described in the previous pages.

Research

In the foregoing pages we have described the *results* of the activities of the Fairey Aviation Co., Ltd., in the form of actual aircraft, of which more than 30 different types and sub-types have been produced during a period of 26 years. It is felt that the story of this fascinating achievement would not be complete without some reference to the *means* whereby those results were obtained.

Basically, one may admit that one very fundamental reason for the success of the firm is to be found in the fact that not only is Mr. Fairey himself a technical man, as well as a man of affairs, but his co-directors throughout the history of the firm have been men with very considerable technical knowledge and experience. But apart from this, there are technical reasons



The float shop at Hayes in 1927. A great deal of research and development work was done, both on materials and hydrodynamic forms.

A REAL FAIREY STORY (Continued)

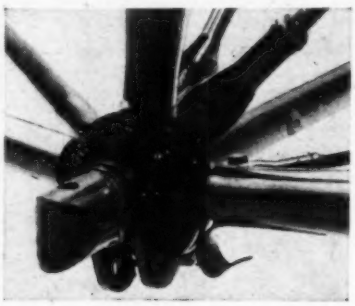
why Fairey aircraft have always had an excellent reputation. The firm has never shirked the expense of undertaking research and experiment. Consequently, before any new type of aircraft has gone into production, the materials of which it is built have been thoroughly tested, and have been utilised in the most advantageous way. And let it not be overlooked that the firm has pioneered a good many developments. In a large way this was demonstrated when Mr. Fairey broke away completely from tradition and produced the Fox, which definitely set up new standards for aeroplanes of the biplane type. But in smaller ways also the Fairey Aviation Company has broken much new ground.

Since the advent of the variable-camber gear, which was invented by Mr. C. R. Fairey and incorporated on the firm's aircraft in the early days of aviation, the company has always been keenly interested in improvements of this invention, and has concentrated a great deal of effort on the development of high-lift devices and flap arrangements. Considerable research and development have been carried out and is still progressing.

Reference has already been made to the trailing edge flap which was fitted to a Fairey machine as early in the series as the Hamble Baby. It is only fair to recall the fact in these days, when all modern aircraft have flaps of one sort or another. Nor has the Fairey Company stood still in the matter of flaps, and in recent years the firm has introduced the auxiliary wing type of flap, which can be set at a negative angle to act as an air brake, without change in lift and pitching moment. This type of flap was to have been incorporated on the F.C.1 commercial aeroplane, which had to be "shelved" when war broke out.

The Spool Joint

Joints have ever been a problem in aircraft structures (there are so many of them), and as early as 1920, when the firm first began to use tubular metal construction for fuselages, a patented type of joint was introduced. This took the form of a steel "spool," which formed the anchorage for a large number of members meeting at one point. Apart from welding, the Fairey spool is probably the neatest type of joint ever used in tubular construction.



The Fairey spool joint provided a very neat assembly of many members meeting in one point.

Mention of welding reminds us that this was one of the fields investigated by the Fairey Company. This form of construction had attained a good deal of success on the Continent, notably in Holland, where the Fokker works made rather a speciality of it. The Fairey works made extensive tests on welded structures and welding methods in 1924-25. Following this work, the company investigated electric welding of light alloys, and was one of the first in this country to produce a spot-welded wing in light alloy.

A small item, but one which in its way has done much to improve the lines of aircraft, was the Fairey cowling turnbutton. This made possible the attachment without unsightly and drag-producing excrescences of engine cowls to a skeleton framework, and at the same time the cowls could be removed in an instant to give access to the engine. More recently an improved type of fastener has been introduced.

By 1924 the Fairey Aviation Company turned its attention to armament equipment. What really gave rise to this was the introduction of the Fox. Its speed was so great that the type of gun mounting which had been used previously was no longer satisfactory, and a new type was developed by the company. This became known as the Fairey high-speed gun mounting, and was fitted on a number of Service aircraft.

The close connection of the firm with seaplane production brought it into early contact with corrosion problems, and much testing and research work was undertaken at Hamble in order to discover the behaviour of different metals in a humid, salt-laden atmosphere, or in actual sea water. This work began with steels, and when light alloy construction "came in" it was extended to aluminium and other alloys.

Realising the very close connection between aerodynamic efficiency and engine-cooling drag, the Fairey com-

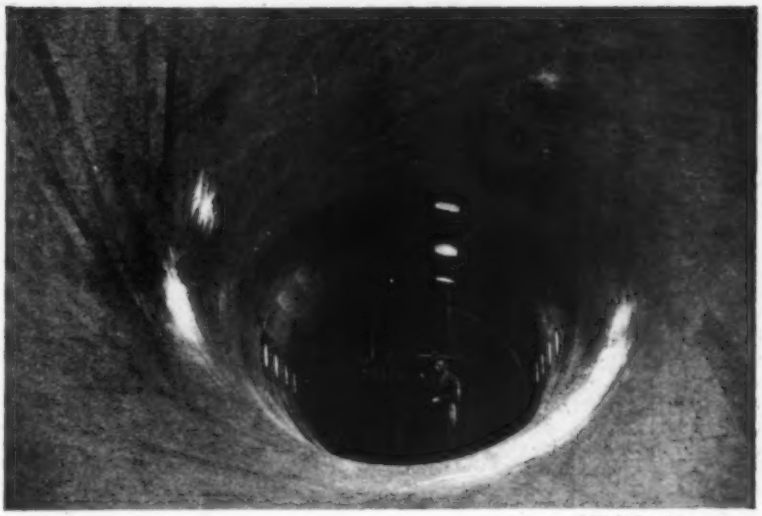
Pre-power turret days. A Fairey high-speed gun mounting in action. This served well until modern times.

A REAL FAIREY STORY
(Continued)

pany began shortly after the last war a systematic investigation of cooling problems. The Fairey Pintail (1920) had an underslung radiator with shutters formed in the undersurface of the engine cowling. From a cooling point of view this arrangement was satisfactory, but the installation and accessibility were not all that might be desired, and an improved design in the form of a retractable radiator was incorporated in the Fox in 1924. In 1930 the firm made extensive experiments with the so-called evaporative cooling system, and the following year an improved system was installed in the S.9/30. This had condensers of the wing-type element construction, mounted on the underside of the roots of the top plane. The steam cooling system was abandoned when ethylene glycol cooling was introduced, and experiments with the latter are still proceeding at the present time. Mr. G. Lyon, now assistant works manager, did considerable research work on evaporative cooling systems.

Mention has been made in the early part of these notes (1925) of the enterprise of Mr. Fairey in overcoming the practice of carrying all sorts of equipment externally, where it added drag and decreased performance. To prove his point he had to build the Fox as a private venture, and into it he put the Curtiss D.12 engine, which later became known as the Fairey Felix. Since that date the company has carried out very considerable work in connection with research and the development of aero engines. Mr. G. W. Hall, now assistant chief engineer, was placed in charge of engine development. Capt. A. G. Forsyth joined the company during this period and took over the engine design and airscrew sections.

Apart from actual aircraft, a most important product of the Fairey Company is metal airscrews. This section provides yet another instance of the foresight which Mr. Fairey and those associated with him have shown throughout the history of the firm. In 1924 the wooden airscrew was still in general use and the variable-pitch airscrew, although in existence, was not considered to be worth its weight and cost for aircraft of the time. But an American, one hardly knows whether to call him a designer or an inventor, had evolved a metal airscrew made of duralumin sheet, the pitch being obtained by twisting and the blade section by machining the blank to the desired shape. Theory indicated that these thin sections should be more efficient than the thicker sections which were necessary for strength of wooden blades, and Mr. Fairey obtained the British rights from Mr. Reed, the inventor or designer.



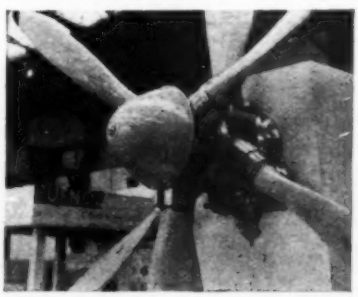
"Flight" photograph.

A view inside the new Fairey wind tunnel. The model suspended in the tunnel may be recognised as that of the F.C.1 commercial type.

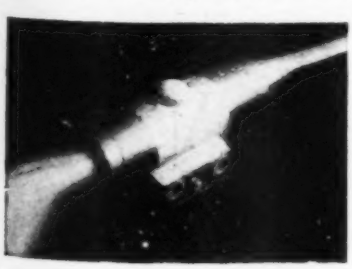
The Fairey-Reed metal airscrew underwent development during the following years, and achieved great popularity for service and civil aircraft. Purely from the technical point of view, the high-water mark was reached with the airscrews produced for the series of Schneider seaplane contests. We believe we are right in stating that in one of the later Schneider seaplanes airscrew efficiencies were of the order of 80 per cent.

It was not until the building of the Fairey long-range monoplane was under way that the need for variable-pitch airscrews became insistent. For that machine a somewhat elementary variable-pitch airscrew was designed. It had three pitch positions, the object being to provide the best possible efficiency at take-off (with a very heavy load) and at successive stages of lightening of the machine as the flight progressed. This airscrew was not actually used on the record flight as it was not finished in time. The pitch increase was operated by centrifugal force, and there was no means of reducing the pitch during flight.

While the Fairey-Reed type of fixed-pitch airscrew was satisfactory for engines of lower power and with direct drive, the introduction of engines of higher power, geared and supercharged, brought new airscrew problems. The Fairey Company, in its customary manner, set to work on airscrew research and development, and a whole series of adjustable-pitch airscrews and controllable-pitch airscrews were produced, all for engine powers from the Gipsy to engines of more than 1,000 b.h.p. To illustrate how



The Fairey contra-running airscrews with controllable pitch.



Left, an early type of adjustable-pitch airscrew. Right, a three-bladed controllable airscrew with spinner.

A REAL FAIREY STORY (Continued)

up to date the Fairey airscrew section is we may recall that at one of the Royal Aeronautical Society's garden parties a pair of contra-running electrically operated airscrews was shown.

The New Wind Tunnel

In more modern days a very complete and up-to-date research department has been established. This was officially opened by Sir Kingsley Wood, then Secretary of State for Air, in 1938. This department includes a wind tunnel of the closed-circuit type, with a three-component balance measuring separately total lift, total drag and pitching moment. Mr. M. S. Hooper, who joined the company in 1929, is in charge of the wind tunnel section. The research department also contains a particularly well-equipped mechanical test section, under the direction of Mr. Woodsmith, and a metallurgical and chemical laboratory with Mr. W. E. Cooper in charge. While research on the F.C.1 was going on in the laboratory, Mr. Richard Fairey, Junior, did technical liaison work with operating companies to ascertain civil air-line requirements.

The head office at Hayes is housed in a modern building, which contains the administrative staff which is divided into three main sections: (1) the drawing and technical offices and research department under the direction of Mr. A. C. Barlow, chief engineer. (2) The general commercial staff, under the direction of Mr. C. C. Vinson, consists of wages and accounts sections (Mr. J. C. Macpherson), the contracts and insurance sections (Mr. H. H. Chennell), and the buying department under Mr. C. C. Perrins. (3) The works manager's department (Mr. W. Walmsley, with Mr. G. E. Toms and Mr. G. Lyon as assistants). The staff includes the works office, the progress department (Mr. H. S. Locker), and the jig and tool section.

A brief reference to the different works may be of interest in concluding this historical sketch of the career of the Fairey Aviation Company, Ltd. We have already mentioned briefly that a beginning, a very small beginning, was made with the drawing office situated in Piccadilly, a small wooden shed leased from the Army Motor Lorry Company in North Hyde Road, Hayes, and the Admiralty sheds at Hamble. From these tiny acorns were to grow the mighty Fairey oak. Mr. A. C. Barlow, who is not related to Major T. M. Barlow, by the way, was the first O.C. drawing office in Piccadilly. He is now chief engineer of the company. In 1916 the firm took over from the Army Motor Lorry Company a small factory in Clayton Road. This was used for producing the Hamble Baby and the Campania. In the same year Mr. B. G. Slater took charge of the Hamble works, of which he is still works manager.

The firm's first "aerodrome" was at Harlington, near the works. Here the drawing office was installed in 1917. The aerodrome soon became too small (it was never really satisfactory) and permission was obtained to use the R.A.F. aerodrome at Northolt. Here all Fairey landplanes were tested until the Great West aerodrome at Harmondsworth was bought in 1929 and made fit for use by the following year. Much work was devoted to the levelling and draining of this aerodrome, with the result that it became the most perfect privately owned aerodrome in the country.

When production of the Hamble Baby, Campania and early III As had been completed, the factory in Clayton Road was closed down and work was transferred to the present site in North Hyde Road. That happened in 1918.

In 1931 the Fairey Aviation Company, Ltd., took a step which had no parallel in the history of British aviation. A branch factory was established at Gosselies, in Belgium, under the title *Avions Fairey*. The factory was under the direction of Mr. E. O. Tips, who had been a member of the early executive staff. The Fox and Firefly types were considered particularly suitable for the foreign trade, and it was on them that the works at Gosselies began. Soon considerable numbers of these machines were in service in the Belgian Air Force. In addition to military types, Mr. Tips produced at Gosselies the tiny Tipsy monoplane, both as a single-seater and as a two-seater. Before the war the Tipsy was in production in England.

The Stockport factory was opened in the latter part of 1935 under the control of Major T. M. Barlow, director and general manager, with Mr. S. Hewitt as secretary and Mr. S. G. Custance as works manager. The works were planned for large-scale production of the Battle aircraft.

The opening of the factory entailed the transfer of several highly skilled men from the head offices of the company's organisation at Hayes. Mr. H. L. Pearce and Mr. A. Vines were appointed as assistants to Mr. Custance, who planned the large-scale production arrangements. Mr. R. McNeillie, production and works engineer, was in charge of the jig and tool section, with Mr. F. H. Hockley as his assistant. Mr. F. H. Ordidge, design and technical officer, and the inspection department under the charge of Mr. S. G. Sleeman, were responsible, under the guidance of Major Barlow, for the success of the production Battles.

In a remarkably short time from the opening of the factory, the aircraft were being delivered, which speaks well for the team-work spirit in which the organisation had been planned. With the Battle and its whole organisation well under way, the Stockport works provided a worthy contribution to the nation's war strength.

All honour is due to the technical and works staff who have always maintained that high standard which has made the Fairey name world-famous.

In conclusion, we should like to express our thanks to Mr. P. Morrey, A.F.R.Ae.S., for his invaluable assistance in compiling these notes. Mr. Morrey is particularly qualified to do so, for he was with the Army Motor Lorry Company when the original shed was taken over to become the first Fairey "works," and he has been with the Fairey company ever since. Thus his recollection of aircraft, events and personalities has been to us an inexhaustible source of information upon which we have drawn liberally.

"Think on these things." The Hayes works in 1916.

Air Strategy—XLI

ATTACK AGAINST BRITAIN—II

Lessons of the Tactical Employment of Fighters and Bombers in the Present War—IV

By CAPTAIN NORMAN MACMILLAN, M.C., A.F.C.

THE earliest air attacks on Britain were directed against naval objectives. Naval anchorages were attacked by bombers with singularly small success. The number of aircraft employed on those raids was never large, and it is not easy to comprehend what the German staff expected to gain through them. More important—because of the greater counter action called for—were the mine-laying raids against estuaries and coastal waters; the early magnetic mines were a decided nuisance, but once the principle upon which the mine worked was discovered it was not long before the *degaussing* of ships was invented, and other steps were taken to render the magnetic mine a negligible danger to ships.

The *degaussing* of the ships not only destroyed the magnetic field which had operated the sensitive needle of the mine, and had thereby closed the firing circuit, but it applied a positive reverse action which deflected or held the needle over to the safety position. Means were devised to sweep the magnetic mines to destroy them by self-ignition without danger to the sweepers. Thus, the scientists quickly provided a satisfactory answer to the tactical employment of the German mine-laying aircraft.

Unlike the anchorage raider, who generally came by day (or at least at dawn or dusk), the mine-layer stole over the sea at night and dropped his mine-laden parachute under cover of darkness. He was, therefore, a difficult aircraft to deal with. Mostly he came singly, and even if he flew low, as was necessary for the purpose of reasonable accurate mine-laying from the air on account of the wind-drift of the parachute, he had a good chance of getting in and out of the roadsteads without molestation, except for the odd chance of a trawler armed with Lewis guns. The low flying height of the mine-layers brought them within easy range of Lewis guns; and several have fallen to the sea-borne machine guns. Other methods of dealing with these nocturnal mine-droppers exist, but they are secret.

Ample Warning

It has always seemed to me astonishing that the Germans managed to spring this particular form of mine-laying upon Britain as a surprise. As far back as 1936 German manufacturers of heavy weight-dropping parachutes advertised their wares. What did the British intelligence gentlemen think that those weight-dropping parachutes were intended to be used for? Perhaps they tried to find out (I don't know whether they did or not, but I expect that they must have done something), and knew all about everything except the principle upon which the magnetic mine worked. But what saved Britain from a very bad time right at the beginning of the war was the German failure to exploit their surprise on a sufficiently large scale. Mines laid from the air were few in number, the work was done sporadically, and a solution was found before the method of attack had opportunity to do much harm. As with the German use of gas at Ypres in 1915, and our use of tanks on the Somme in 1916, the German use of the magnetic mine in 1939 was carried out on too puny a scale. It is almost incredible that militarists make this mistake over and over again with the tactical employment of new weapons devised for them by industrial scientists, but they do.

The Royal Air Force was not slow to retaliate with a campaign of mine-laying in German waters. Hampdens were first fitted out for this duty. The Royal Air Force did not stop at the laying of minefields in German coastal waters, both in the North Sea area and in the Baltic, but devoted a certain amount of effort to the mining of inland waterways used for German inland water communications.

Mining a Land Power

This ability of the aeroplane to mine inland waterways is a new departure in warfare between an essentially maritime power like Great Britain and an essentially land power like Germany. The tactical value of the mining of inland waterways cannot be assessed outside official circles, and possibly not even within them, because of the difficulty of obtaining information of the results, but it is obvious that anything which slows down the speed of inland water transport in Germany is of value, even if direct material loss is slight.

Loss of time is the one thing which can never be replaced, either in war or in the life of a private individual. And whatever tactical measures can be devised to restrict the fourth dimension to the enemy are of undoubted strategic importance. In this respect the mining of German (and German-controlled) inland waterways may be not less valuable than the bombing attacks which were made by the Royal Air Force against the aqueduct of the Dortmund-Ems Canal during one period of the war against industrial Germany. The mining of inland waterways is complementary to the external blockade which can be applied by naval power. In the case of Germany to-day, when the external blockade is less complete than it was in the Great War, it would appear to be a development in air power which is deserving of full exploitation by Britain, for in this country we offer no adequate *quid pro quo* to the enemy.

During the early period of the war, when mine-laying and raids against targets of purely naval importance were the principal duties required of the bombers of both sides, fighters found relatively little to occupy them. Targets were few and fleeting, and there were long spells of inactivity when there was no fighting to be done. In such circumstances there seems to be good reason for employing fighters upon duties other than those for which they were specifically designed and organised, but to obtain full value from them it would be necessary to increase the range of the average fighter.

The difficulty which is immediately met when endeavouring to increase the range of a relatively small aircraft is to find a place to put the extra fuel. So much space is already taken up by the engine, cockpit, existing tanks, guns, ammunition, retractable undercarriage and controls, oxygen equipment and so on, and what is left is probably in an awkward part of the structure, in relation to feeding the drink to the engine, to the fore-and-after centre of gravity, and to the lateral equipoise of the aircraft during manœuvre. So, what?

Clearly, it is undesirable to tamper with the certainty of the fuel feed, or the safety of the aircraft in flight; thus some other solution must be found to increase the

ATTACK AGAINST BRITAIN (Continued)

range of fighters if they are to be capable of employment upon other than extremely short-range defence (in which category I include the sweeps of limited range which have been made over Flanders in recent weeks).

To be acceptable any solution must not seriously invalidate the immediate readiness of fighters for their primary duty of carrying out the most efficient dynamic defence of areas attacked by aircraft.

Several methods to increase aircraft duration have been proposed, notably the Mayo composite method, the Pemberton-Billing slip-wing and towed fighter methods, and the Cobham refuelling-in-flight method. For the type of work I have indicated there are objections of one kind or another to all these methods when they are applied to fighters. Let me say at once that I do not seek controversy. Each of the methods I have mentioned has a doughty champion of its worth behind it, and each has merit. But I doubt if any one of the methods entirely satisfies the condition which I have defined. The composite method increases the range only while the twins are Siamese. In that condition the speed is necessarily considerably reduced, and that one cannot afford without losing the advantage of the fighter type of aircraft. Part the portions of the composite, and the range of the fighter returns to what it was on the ground plus the fuel which would have been used if the fighter had had to get to the point of the parting of the ways by itself. With the short distances between British bases and Continental bases in German hands, the advantage of the composite method is necessarily curtailed; the fault is not the fault of the composite system, but that the circumstances are unsuitable for its employment; the idea was not conceived for the present emergency.

The towed fighter is intended to provide a means of increasing patrol duration and to place fighters in the most advantageous position to attack bombers; it is a defensive rather than an offensive proposition in the existing condition of the war in Western Europe.

The refuelling-in-the-air method does not appear to apply to the short-range fighter, for it does not overcome the inherent difficulty, which is to find room for the extra fuel; the object of refuelling-in-the-air is to overcome the handicap of a low power/weight ratio; in the short-range fighter the power/weight ratio is high.

For the object in view the slip-wing fighter has no greater advantage to offer than the composite aircraft, for its purpose has been described as the prolongation of patrol at the expense of speed until the moment the fighter is detached to go into action.

Fighter Range

Obviously, some other means of increasing the fuel capacity of high-speed fighters is required if they are to be employed to attack in daylight targets beyond an operational range of a hundred miles (or thereabouts) from their base aerodromes. It is certain that before this war is over it will be necessary for British high-speed fighters to possess a more extensive radius of operation. Otherwise, with the bases at our command it will be exceedingly difficult to carry the air war into the enemy territory in Europe in daylight, and British fighter action will be limited to a narrow zone of territory lying opposite the south-eastern corner of England.

Personally, I believe that the solution to this problem must be sought along the entirely rational line of increasing the tankage of high-speed fighters. There are several ways of adding tankage without adding too much resistance, and they are well worth investigation and experiment with a view to incorporating additional duration in our fastest fighters before the long days are upon us. The object is to increase duration, when required, with the minimum loss in speed and without detracting from present performance of fighters in standard form. It can and ought to be done.

I have already dealt with the period of maximum air activity against Britain during the period following the capitulation of France. It remains in this article but to bring the consideration of this phase of the war up to date from the time of the end of the daylight attacks against Britain. From the moment when the German High Command apparently decided that the time was not appropriate (to put it in a generous way) to commence a general assault upon Britain last autumn, the tactical employment of the *Luftwaffe* was swung round from direct military objectives to targets which can be best described as falling into a pattern of air blockade.

Two Forms of Blockade

As I stated in an earlier article, air blockade cannot achieve its object, as can sea blockade, by the process of withholding. Its object can alone be gained by the process of destruction. It seems that the British citizen generally has been slow to grasp this essential difference between the two forms of blockade. Many of them have asked me what possible object lies behind the German air attacks, which to them appear to represent simply an attempt to destroy without having any process of reasoning behind the process of destruction.

Certainly some of the results of German bombing in Britain justify this point of view. But it must be remembered that an isolated incident, or even a number of separate incidents, do not present the full picture of the tactical employment of the *Luftwaffe* against Britain during the past five months. That complete picture is not available to the public, nor can it become available until after the war, for it is obviously impossible to disclose all the damage done everywhere. This non-disclosure of all the details of bomb raid destruction does not mean that the intention is to minimise it, either to the British public or to the German staff, so that both will believe the damage to be less than it actually is.

Even photographic information of the effect of air raids may fail to disclose the actual damage caused. In some cases an air photograph will emphasise external damage when internal damage to a building may be slight and relatively unimportant. This is important in relation to industrial targets, in which the interior of a building as represented by its contents may be of extreme value to the national effort, while the structure of the building itself is of comparatively slight importance.

Here, then, is a clear indication of the necessity for any country which undertakes a campaign of air blockade to possess an effective intelligence system within the country so blockaded. Otherwise much of the value of air blockade damage cannot be accurately known, and an estimate of its percentage of effectiveness must be in the nature of guesswork. It is therefore in air blockade war more necessary than in any previous form of war to guard against spies and agents of the enemy, and to refrain from disclosing precise details of damage caused by bombing.

Personally, I take it as an encouraging sign that

ATTACK AGAINST BRITAIN (Continued)

Germany during the period under review used large concentrations of aircraft against a succession of targets in industrial and commercial areas. It indicates (to me, at any rate) that this policy was forced upon Germany because the German staff were unable to obtain accurate intelligence reports and had therefore to resort to quantity raids in an effort to achieve by weight of attack what they were uncertain of achieving and confirming by any other means. By the adoption of this policy the German Air Force has caused a considerable amount of damage which has no direct bearing upon Britain's war effort. It is a negation of the adage of the employment of the concentration of force in war, for, to achieve the effect desired upon one or a small group of targets, the *Luftwaffe* was sent to plaster the whole area around these targets; the German staff thus did something entirely new in air war, namely, they dispersed their force by over-concentration.

This tactical handling of an air force is necessary under appropriate conditions, as, for example, when enemy forces are concentrated for attack. But physically, materially and psychologically it does not achieve the purpose which the Germans apparently expected it would achieve when it is applied at the wrong time. The Germans always were poor psychologists. In the spring of 1918 they dispersed their ground power in a similar way. In his employment of the *Luftwaffe* in the autumn of 1940 Göring became the aerial successor to Ludendorff, the ground general who confused concentration of effect with concentration of the employment of the force at his disposal. Concentration of force means the use of all the power at one's disposal. In air war it does not mean the interpretation which the German air staff placed upon it when they planned their night attacks against Britain after their day attacks had failed. Tactically, the R.A.F. flyweight was far more effectively handled than Göring's heavyweight; one showed clever sparring, the other failed to land a knock-out.

(Next week: Greece and Albania.)

Rapid Growth of the A.T.C.

NO fewer than 138 schools in Great Britain are included in the second list to be issued of units, registered under the new Air Training Scheme, which have received authority to raise squadrons or flights. A third list of new units contains an additional 27 school and local squadrons, 23 of which are in England, three in Wales and one in Scotland.

The first list contained the names of 91 registered local units, so the total approved so far is 256. Of those on the second list, 111 are schools situated in more than 20 English counties in addition to Greater London, 16 are in Wales, 10 in Scotland and one in the Isle of Man.

Incidentally, England's smallest county, Rutland, is represented by Uppingham, whose head master, Mr. J. F. Wolfenden, is Director of Pre-entry Training at the Ministry. Appropriately enough, this was one of the very first school units to be registered. Scotland's smallest county, Clackmannan, which has a population of just over 30,000 in its 55 square miles, hopes to raise no fewer than eight flights, for it is anticipated that out of 600 boys between the ages of 16 and 18 years, one in every three will join the A.T.C.

The Air Ministry has just issued a pamphlet entitled "The Royal Road to the Royal Air Force," which explains how the A.T.C. scheme will work and how those interested can play their part in it. Copies of this pamphlet, which has an attractive coloured cover, can be had on application to The Information Bureau, The Air Ministry, Adastral House, Kingsway, W.C.2.

S.B.A.C. Scholarships

PARENTS are reminded that boys between the ages of 16 and 18 years who wish to become qualified aircraft engineers with a view to taking up professional careers in the industry, but who are unable, for financial reasons, to undergo the necessary course of education, have a splendid opportunity to achieve their ambition through the scholarship scheme instituted in 1936 by the Royal Aeronautical Society in conjunction with the Society of British Aircraft Constructors.

This scheme, which in no way clashes with the new Air Training Corps designed purely to feed the ranks of the R.A.F., grants a minimum number of four scholarships each year. These are normally tenable for four years and to a maximum value of £100 each. Since the scheme was begun, 30 such scholarships have already been granted and local education authorities are invited to bring the scheme to the notice of headmasters of those secondary schools which are considered suitable for this purpose.

The actual value of the scholarship depends upon the circumstances of the holder, the intention of the society being to supplement the boy's means up to an amount sufficient to enable him to maintain himself during his training. To this end the amount of the award to each holder is subject to annual review. Appointments to the scholarships are made by a selection committee from among candidates who have obtained a recognised schools' certificate or its equivalent. All candidates must be British subjects and between the ages of 16 and 18 years on September 1st in the year of the award, which is normally made in March or April.

Scholarships are tenable with certain selected firms and, whenever possible, the candidate is allowed to choose the firm with which he prefers to undergo his training. The holder of the scholarship is elected in the first instance for one year, but the tenure will ordinarily be prolonged to four years, contingent upon satisfactory work being done by the holder. All holders of S.B.A.C. scholarships are expected to qualify for a technical grade in the Royal Aeronautical Society and any boy who wishes to apply for a scholarship should make application for a form direct to the society, at 4, Hamilton Place, London, W.1, and return it, filled in, not later than February 28th.

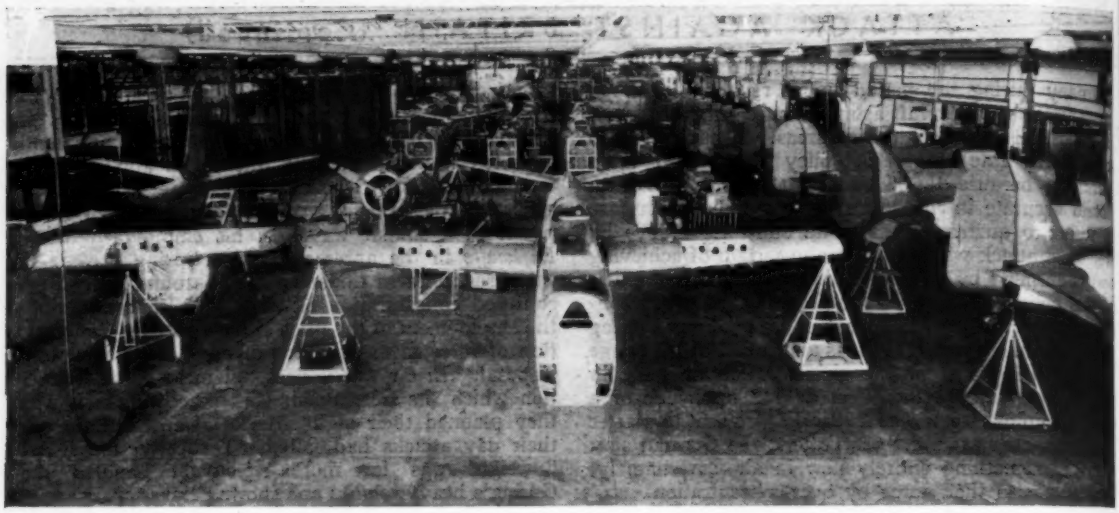
London Scientific Film Society

THE next show of the London Scientific Film Society will be held on March 1st at the Polytechnic Theatre, Regent Street, but the subject has not yet been announced. At the first show for the season, held on February 8th, the subject was aviation, and the Society put on a very good selection of films. The first half of the programme depicted the development of the aeroplane from the early years of this century up to 1939. Some amusing glimpses were seen of the stout-hearted pioneers of the days of Santos Dumont, Wright, Blériot, and Farman in their uncertain contrivances. Then followed a pageant of British Empire communications, right up to the time of the *Golden Hind*, which was seen under construction in Short's factory, but, sadly enough, was destined never to carry its message of peace across the world's oceans.

The second half was as interesting as it was varied. The Air Ministry film of work at Farnborough showed the huge twenty-four-foot tunnel, the spinning tunnel, and the series of "air flow made visible" by the Schlieren method. The G.P.O. Film Unit's "London Can Take It" and our old friend Popeye in an "aeronautical" subject were also on the programme. Finally came "Airscrew," showing the diversified effort which goes to the making of even one component of the aeroplane. To those who like science, the programme was fascinating.

Bombers Across the Atlantic

COL. JOHN JOUETT, president of the Aeronautical Chamber of Commerce of U.S.A., has made the statement that 400 bombers have been flown across the Atlantic to Britain. This seems a large number, and as this traffic has only been going on for about four months, it implies a large number of crews at work, for one crew can deliver machines at the rate of about one per month. The flight over takes only a few hours, ten or so, but the return has to be made by ship, a slow business, since there are bound to be delays in leaving England. Perhaps it will be possible to return the pilots by air soon, which will speed things up considerably. *American Aviation* informs us that there are forty U.S. aviators engaged on this work. This number is in addition to the British air crews engaged. If the 40 are all pilots (which is not stated) they could deliver at the rate of 40 per month; but if air crew generally, 13 per month.



In the Douglas factory at El Segundo, California.

"GIVE US THE TOOLS, AMERICA!"

An Engineer Examines the Export of Aircraft from U.S.A. : American Aircraft Quality : Present Rates of Production and Export

By BRUCE FOSTER, B.C.E., D.I.C., A.F.R.Ae.S.

THIS article is addressed to every American who wishes to retain a world in which he will still be able to register his vote on political questions, in which he will still be able to speak his mind about politics to his friend—or enemy—on the street car, in which he will still have as much freedom as he enjoys now—perhaps even more so, if it becomes possible to bring about some much-needed social reforms. But the article is more particularly addressed to those Americans who are concerned with the production of aircraft, for the retention of liberty in the world depends more on the manufacture of fierce fighting and bombing aeroplanes than on any other mechanical device.

This is unfortunate, for there were many who hoped in the years of the uneasy peace that the times in which abhorrent forms of political thought had to be combated by killing had passed. But the politicians of the world, by their very doubtful dealings, and the peoples of the world, by their mental laziness in refusing to examine the dealings of the politicians and see where they were leading us, refused to look the problem in the face for so long that no other way than a resort to killing lay open.

The killing has now been under way for more than a year ; it will only end when victory has been secured for the Democracies. So the sooner you send us military aircraft in great volume to add to the large numbers rolling out of the British factory doors, the sooner will this spot of bother be over and peace be attained. The totalitarian form of government will bring to us, if its military strength succeeds in war, a way of living which hardly bears thinking of. If they win, the light goes out in Europe, and perhaps in the world, and we plunge into a darkness more intense than that of the Dark Ages. A Nazi victory means the death of the liberal tradition.

With peace comes the real work—the reconstruction of the war-torn world in a form which shall make it safe for all peoples to work in without fear of enormous disaster hanging over them in the shape of economic depression or an outbreak of mass killing such as we are at present enduring. For it seems to me that the only real excuse for waging a war is that the resultant victory gives a period of quiescence in which mankind has an opportunity to plan for peace. In this connection an utterance by Mr. John G. Winant is reassuring. In the first speech made after being appointed U.S. Ambassador to Britain to replace Mr. (Democracy is dead) Kennedy, you will remember that he urged you to "prepare to conquer for peace after the war has been won for Democracy. Only by accepting a far-reaching progressive social change can we hope to secure an economic security which will make peace real and lasting."

Repulse of the "Luftwaffe"

To ensure the victory and to bring the attainment of peace in the shortest possible time, Britain must have greater and greater numbers of military aircraft. Large quantities are being made over here, but we want more from U.S.A. The quality of your aircraft is good—despite a few uncomplimentary remarks made by a very few of my countrymen. My own acquaintance is more with civil aircraft, and in another country before the outbreak of war, but after seeing your transports doing regular service on airlines and being able to compare them with the products of other nations, I have the greatest respect for them. As far as military aircraft go, it is evident from what you have sent over here that, structurally and aerodynamically, they are good aeroplanes—and, what is more, good fighting aircraft when fitted with armament in accordance with British ideas of adequate fire power. The ideas of many machine-guns and power-operated turrets in fighters and bombers respectively were adopted in this country before the outbreak of war, and they have proved themselves completely. Together with the personal qualities of our airmen and the flying qualities of our aircraft, they are responsible for the repulse of the *Luftwaffe* in the second half of last year. If the *Luftwaffe* had not been repulsed, it seems very probable that Germany would have then gone on to victory during 1940 over the United Kingdom—but not all the Democracies, for the fight would have been continued in other countries all over the world.

Let us take stock of the situation and examine just what you have sent us since the start of this war. The present is an appropriate time to do so, for Mr. Wendell Willkie left a few days ago on his return home to tell you what

"GIVE US THE TOOLS, AMERICA!" (Continued)

he saw of the bombing of some of our towns and how he learnt to play darts. By the time you read this he will have given his evidence in regard to the Lease and Lend Bill, and, as most people over here confidently believe, the Bill will have been passed. The passing of such a Bill means the linking of arms, both figuratively and literally, of the two most democratic nations in the world, and there are many of us who hope that the bonds which at present unite us will grow into a permanent union.

DATA ON U.S. AIRCRAFT EXPORTS

	To United Kingdom	To France	To Canada	Total	Total U.S. exports to world
1939					
Jan.	20	25	3	48	72
Feb.	43	29	3	75	114
Mar.	44	36	1	81	130
Apr.	50	10	8	68	108
May	75	15	3	93	156
June	53	52	2	107	148
July	42	53	10	105	121
Aug.	44	57	15	116	137
Sept.	34	0	5	39	60
Oct.	0	0	0	0	43
Nov.	4	19	16	39	62
Dec.	53	171	2	226	294
Total for 1939	462	467	68	997	1,445
1940					
Jan.	41	66	14	121	233
Feb.	19	47	11	77	180
Mar.	2	122	11	135	210
Apr.	23	168	4	195	233
May	19	95	5	119	309
June	97	193	27	317	372
July	173	0	85	258	338
Aug.	278	0	75	353	383
Sept.	136	0	68	204	284
Oct.	177	0	102	279	335
Nov.	190	0	48	238	284
Total for 11 months ..	1,155	691	450	2,296	3,161

The first table in this article gives a summary of data on U.S. aircraft exports, the second of engine exports. Examination of the first shows that American exports are rising substantially. This is a comforting fact and augurs well for the future, for we know that your production has not yet got into its wartime stride. Those of us who are engineers know well the difficulties of making aircraft in large numbers and just how long it can take to double the output of a factory, let alone multiply it by five or six or seven times.

But we have great faith in your undoubted ability to turn out aircraft in large numbers, and know that these will ultimately be forthcoming in sufficient volume to satisfy our most exacting demands. What we wish to urge upon you, however, is the need for speed, for a glance at the column of exports to the United Kingdom shows that these monthly totals are not large, not even now, when the war has been going for some 17 months. Striking a rough average of about 190 per month for the later months of 1940, this is only a small fraction of our own production. (No official indication of our own rate of production is given, but from visits to factories one can obtain some vague ideas.)

You will probably raise your eyebrows at a request for speed from this side of the Atlantic, from we British who have a reputation—well deserved, I am afraid—for being rather slow off the mark. But that is merely so that this unfortunate mess can be cleaned up as soon as possible and we can be free to return to our life's work and carry on with the things which we like doing.

We know you are getting on with the job of production, for figures show that the value of aeronautical exports during the first ten months of 1940 was just over three times as great as the total for the same period of 1939. The respective totals are $252 million and $81 million. But we don't care how much faster you go.

DATA ON U.S. ENGINE EXPORTS

	To United Kingdom	To Canada	To Australia
1940			
May	5	68	19
June	25	26	6
July	77	315	0
August ..	248	105	27
September ..	256	123	—
October ..	379	142	—

It is interesting to observe the increase in size of aircraft exported. During 1939, a total of 1,211 aircraft were exported, valued at $65,513,000. This gives an average price of $54,000 (£13,400) each. But during August, 1940, the 278 aircraft valued at $22,665,000 averaged $81,600 (£20,200) each, showing that they were bigger aeroplanes. So in judging the rate of increase of American exports, one should compare not only numbers but also take into account the size, which is very nearly directly proportional to the cost.

The total aeronautical exports of U.S.A. during the first eight months of 1940 were made up thus:—

To the United Kingdom ..	$62,092,000	(£15,500,000)
To Canada	$16,435,000	(£4,100,000)
To Australia	$10,845,000	(£2,700,000)
	$89,372,000	(£22,300,000)

This shows that the British Empire is getting nearly half of the U.S. export total of $198,640,000. ("Aeronautical exports" includes complete aircraft, airframes and parts, engines and parts, and all accessories.)

Present Rate of Production

Our daily papers are becoming full of names of new American types, more than our memories can retain. Tomahawk, Liberator, Ventura, Lightning, Catalina, Mustang, Vanguard, Buffalo, Boston, Martlet, Mohawk, Maryland and Baltimore—more and more of them, and if names were hundreds, the war would be as good as over. But we know that the figures which have been quoted at various times by our daily papers as "round" and "approximate" and "just under" and "nearly" and "attained soon" have not been borne out by the figures of exports which your official sources in the U.S. Department of Commerce have published.

This is not your fault, as your responsible engineers at the head of your big aircraft factories have not drawn exaggerated pictures of what they could produce in any given time. They also know the great difficulties confronting an enormous expansion programme, when men have to be trained to do new jobs, when enormous machine tool purchases have to be made and huge new buildings erected to house men and tools.

Your total production of all aircraft, both civil and military, during 1939 was at the rate of 488 per month, but this has now increased considerably, as it was announced that during December, 1940, a total of 799 of all types was made. But more than half of each of these figures consists of small civil aircraft.

Mr. T. P. Wright, whose position as a technical head of one of your great aeronautical companies ensures that his words will be listened to with respect, has made some esti-

"GIVE US THE TOOLS, AMERICA!" (Continued)

mates about the rate of expansion which can be expected. Starting with a rate of production for May, 1940, which he gave as 500 per month, Mr. Wright estimated that "a production of approximately 2,000 per month can be achieved in 2½ years, or by January, 1943; a rate of production of 3,000 planes a month can be attained in four years, or by the spring of 1944; and a rate of just over 4,000 planes a month can be realised in five years, or by July, 1945."

Analysing these figures, it is evident that Mr. Wright thinks the American aircraft industry can be expanded at such a rate that, in one year, the rate of production can be raised by 600 or 700 per month. Using the average rate for 1939 and the December, 1940, total, the monthly rate has gone up in one year by 311 aircraft. This is just half Mr. Wright's expectation. Though we did not expect it, we secretly hoped his estimates would be proved wrong—that the expansion rate would be greater than his figures. But so far it is smaller.

I say "so far" because, in the throes of getting under way, you have great difficulties to contend with, and it is possible that your rate of expansion may show better figures than this during 1941, when some of the organising troubles in the machine tool, material and other allied industries are smoothed out. At any rate, we hope so and believe so, for we have great confidence in your ability to get things moving. But make no mistake, *we want those aeroplanes.*

Inefficient Bombing

We are up against a ruthless, brave, and in some ways clever enemy. Only the unthinking underestimate either the ruthlessness or the bravery of the enemy. One cannot underestimate the bravery of any airman who will attempt to dive-bomb a warship by diving his Stuka down into the fire of the eight-barrelled pom-poms which play so deadly a tune that they are known as "Chicago pianos." Nor can one doubt the enemy's ruthlessness when, after a night in an air-raid shelter, made restless by the drone of bombers and the occasional *swish* and *crash* of the bombs, one goes home in the morning, and on the way looks to see "whose house has copped it this time." (Of course, other things as well as houses also "cop it" sometimes, but one cannot respect the bomb-aiming.)

The cleverness of the enemy should not be underrated, but when one looks at some of the things he has wasted his bombs on one feels inclined to call him stupid. Many of these bombs could have been placed with greater effectiveness—from the point of view of winning the war for Germany—on more important objectives. The bombing of the East End, instead of stirring the inhabitants to revolt against their own Government, merely hardened their feelings against the German "Government." The City of London fire raid of December 29th might be regarded as an attack on an economic objective, and as few people live in this office area not many deaths were caused. But it does almost nothing to slow down the war effort in this country, and the whole attack could be regarded as quite misplaced.

Make This Information Secret

The Germans know the exact measure of American production during any month—that is certain. To believe otherwise would rate the German intelligence at lower than normal. They have in your country consular officials and numerous other people (including Dr. Dornier's son, who was recently there), and this information should be quite easy for them to obtain. Export figures are published freely by your Department of Commerce, so they have no trouble in obtainmg these.

It is suggested that this information be not released to our enemy, as it is of value to him. We do not mind not knowing it if it is also kept from the Germans. Perhaps you can do something about this.

The fact is that we have not as yet received a large total of aircraft from you—for the first twelve months of the war it totalled 743, which is only an average of 62 per month. August was the month with the best total, and succeeding months have not shown totals as large. But this fact does not depress us—it heartens us. For have not the R.A.F. met and repulsed the *Luftwaffe* and covered themselves with glory in doing so?—and this before any considerable American help had arrived. (Except for the Hudson.—Ed.) How much better will the situation be when that help does arrive, as assuredly it will, in most generous measure! For our confidence in the American ability to produce good aircraft in enormous numbers will not be misplaced, and when the Democratic victory has been won, Britain and the liberated peoples will say "Thank You" to the United States.

BOOK REVIEW

"Best Flying Stories." Edited by Norman Macmillan. Faber and Faber, 8s. 6d.

IN gathering together this little volume of twenty-two flying stories, Capt. Macmillan has not only based his selection on the quality of the individual story, but on the unquestionable appeal of variety. They embrace fact and fiction, they come from writers of eight different nations—American, French, Dutch, Swiss, German, Italian and Russian in addition to British—they provide studies in several literary styles, they have for their backgrounds the present war and the 1914-18 conflict as well as the period of peace between, and their settings range on both sides of the Atlantic and both sides of the equator. Himself a writer of no mean order on various aspects of aviation and a frequent contributor to *Flight*, nobody will cavil at Capt. Macmillan having included in the collection a story from his own industrious pen; indeed, the volume would have been incomplete without it! He relates under the title of "The Insalubrious Sea" the story of his ideal, shared by his co-pilot, Malins, when their seaplane was forced down by engine trouble in the Bay of Bengal and they were eventually picked up after two exhausting nights and days when they were clinging to the floats of the overturned and rapidly disintegrating wreckage with poisonous sea-snakes and sharks around them.

There is the heroic story of how the crew of a flying-boat were rescued from the North Sea in the last war, when all seemed lost, because one of their homing pigeons just managed to battle its way to land and was picked up on the shore, dead from exhaustion, with its vital message. That bird was preserved in the squadron mess and its glass case bore a little brass plate with the grateful inscription, "A Very Gallant Gentleman." Capt. Ernst. A. Lehman, with the collaboration of Howard Mingos, relates the story of "Zepps Over London," and there is the late Italo Balbo's account of his homecoming when he landed with his aerial armada on the Tiber to be greeted by Il Duce and cheering thousands after his historic transatlantic venture. In contrasting style are the extracts from the diary of Bert Hall, Spad pilot in the famous Lafayette Escadrille, giving a racy account of aerial activities on the French and Russian front during the Great War, while different again is the simply told story by the late Sir Ross Smith of pioneering perils between Singapore and Sourabaya. Among the fiction are "Curly the Navigator," by Francis Chichester, and a cleverly fantastic comedy entitled "The Flying Yorkshireman," by Eric Knight, that has a laugh in almost every line. The collection very suitably concludes with an account by an R.A.F. squadron-leader of battles over and around Dunkerque, the intensity of which may be gauged by the fact that, on one day, his squadron fought 30 combats, including two before breakfast. Remarking that the bulk of the Hun pilots don't seem to enjoy fighting, he adds, "They simply don't know their stuff. And our aircraft are certainly better." Coming from a man who should certainly know, this makes a most satisfying conclusion to a very entertaining book.

HERE AND THERE

FREE FRENCH FLYING: The Caudron Göeland twin-engined cabin monoplane which a French air-mechanic stole from an aerodrome in occupied France to fly to England. He landed near Tregantle Fort, in Cornwall.

"Flight" Index

THE *Flight* index for July-December, 1940, is now ready and may be obtained from this office (Dorset House, Stamford Street, London, S.E.1), price 7½d., post free, or, with cloth binding-case, 4s. 5d., post free. Readers' copies can be bound for them in the publishers' case at an inclusive charge of 10s. 9d. and will be returned post paid.

Canada Follows Suit

A SECOND case of a collision in mid-air resulting in the aeroplanes becoming locked together is reported, this time from Canada. This occurred at the Macleon S.F.T.S. A safe landing was made by the combination and the two Leading Aircraftman pilots were uninjured, though dazed and unable to give an account of the accident. The lower machine was badly damaged. It will be remembered that the first case of such a strange collision and landing occurred in Australia with two Avro Ansons in October last year.

By Landplane from U.S.A.

MR. JUAN TRIPPE, president of Pan American Airways, has announced that the company will commence a non-stop service next year between the United States and Europe with landplanes. *Flight* expects that the intention is to use Boeing Stratoliners, but who knows what will be happening between the United States and Europe by next year? If things keep on going as they are at present, the service might be to England, not to Europe, as American aircraft might not be any too welcome on that continent.

Fleet Street Squadron

BOYS of 16 to 18 years employed in the newspaper offices of Fleet Street will, it is expected, form their own squadron of the Air Training Corps which is making such rapid progress all over the country. The "Newspaper Squadron" will, if the efforts to raise it are successful, be affiliated to the already formed Holborn Squadron. It is hoped to enrol 100 boys—a full squadron—and applications for membership should be made to Mr. R. C. H. Dunbar, Kingsway Institute, Keeley Street, W.C.2.

U.S. Accident Statistics

THE accident rate for the air transport services of the United States for the January-June periods of the years 1936 to 1940 show an ever-mounting figure of passenger-miles flown per passenger fatality and illustrate very effectively the great safety of air travel. Rounded off to the nearest million passenger-miles, the figures are as follows: 1936, 8 million per fatality; 1937, 11 million; 1938, 13 million; 1939, 39 million; while the first half of 1940 shows an infinite number, since there were no fatal accidents in that period. The passenger fatalities for the periods were small in number, being: 1936, 27; 1937, 22; 1938, 22; 1939, 9. Figures for the July-December periods are all comparable, but it is expected that when the last half of 1940 is analysed it will show a drop back owing to the two serious accidents which occurred. But the whole record still remains a magnificent one in which U.S.A. can take great pride.

"Flight" at One Shilling

FROM next week the price of *Flight* will be 1s., as announced last week, when the reasons for the increase were explained. We regret the necessity, but there is no escaping it. We fully realise that the higher price will impose a real hardship in some cases, and that many of our regular readers will feel themselves unable to continue buying the journal. In such cases we would suggest that readers make a serious effort to get into touch with another reader similarly placed, with a view to arranging copies being passed on from one to the other.

The First Liberator

THE first of the Consolidated B-24 fleet, 26 of which are to be made available to Britain by U.S.A., left the Consolidated factory at San Diego, California, on February 16 on its delivery flight, the first leg of which is across America. The B-24, also known by the firm's name of Model 32, has been christened the Liberator.

Five Years Across the Pacific

THE 442nd flight across the Pacific by the flying boats of Pan American Airways, which was made in January, marked the completion of five years of operation. A total of 3,715,553 aircraft-miles have been flown and over 21 million passenger-miles completed. Carriage of mail totals 768,585 ton-miles and freight 396,632 ton-miles. The number of letters carried is estimated at 13½ million. These prosaic figures have concealed in them one of the most romantic stories in the world, a story of the conquest of the largest ocean in the world by aircraft designers, factory hands, pilots, air crews, meteorologists and radio men. The mileage from U.S.A. to China is 8,746, the longest hop being from San Francisco to Honolulu (2,402 miles). The other stops are at Midway, Wake, Guam, the Phillipines, with the terminus at Hong Kong.

Institute of Aeronautical Sciences

FRANK W. CALDWELL, director of research for United Aircraft Corporation, who has been connected with the development of controllable-pitch and constant-speed airscrews, has been elected president of the Institution of Aeronautical Sciences for 1941. At the honours night dinner on January 28th, Dr. H. L. Dryden, of the National Bureau of Standards, was presented with the Sylvanus Albert Reed Award for his contributions to the mechanics of boundary layer flow and his interpretations of wind-tunnel experiments.

"Down in the Forest . . ."

TWO Spitfires, to be named The New Forest and The King Rufus, are to be purchased for the R.A.F. with money raised by the New Forest Spitfire campaign. The Ministry of Aircraft Production has recently received a second instalment of £5,929 from this fund.

Bombay Fighter Fund

NO less than the equivalent in rupees of £7,500 was raised at a recent Government House "War-plane Ball," held in Bombay for the purchase of fighters for the R.A.F. The Turf Club there decided to give rupee for rupee to the fund, so Bombay's contribution by this latest effort now amounts to £15,000.

Incidentally, 100,000 rupees is called a "lakh" (pronounced "lack") and, as the present value of the rupee is 1s 6d., this represents the sum actually raised at the ball, and to refer to such a magnificent result as being "a lakh of rupees" sounds a little ungrateful—in English.

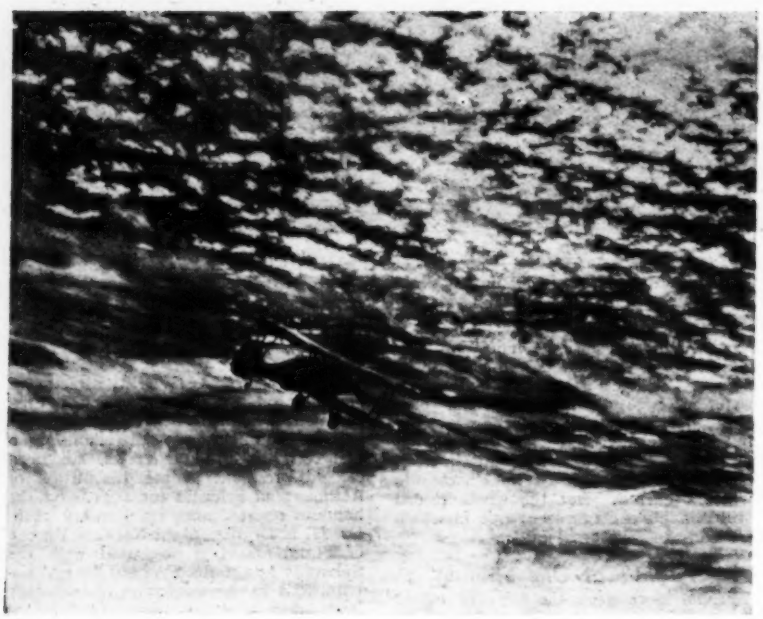
More Dominion Air Crews

AIRMEN from Australia, Canada and New Zealand were inspected at an aerodrome near London recently when the latest contingent of Dominion pilots and air crews to arrive in England were welcomed by Lord Cranborne, the Dominions Secretary. Many of the Australians came direct from Down Under" and, except for operational flights in this country, all the men are fully trained.

Lord Cranborne was accompanied by Mr. S. M. Bruce, Mr. Vincent Massey and Mr. W. J. Jordan, the High Commissioners for Australia, Canada and New Zealand respectively.

Service Aviation

Royal Air Force and Fleet Air Arm News and Announcements



MEDITERRANEAN SKY: A four-gun Gloster Gladiator of the Royal Australian Air Force on patrol over Cyrenaica.

Sir Cyril Newall

THE KING has been graciously pleased to give directions for the following promotion of Marshal of the Royal Air Force Sir Cyril Louis Norton Newall, G.C.B., O.M., C.M.G., C.B.E., A.M., Governor-General and Commander-in-Chief Designate of the Dominion of New Zealand. He is to be an Additional Member of the First Class, or Knights Grand Cross, of the Most Distinguished Order of Saint Michael and Saint George.

Taranto Echoes

IN publishing, a short while ago, some details of the crest of No. 224 Squadron, we are reminded that No. 226 was also formed at Taranto. It was commanded by Major M. S. Marsden under Wing Captain (now Air Chief Marshal) Arthur Longmore. It was equipped with D.H.9s, and just one of the many jobs it did was to drop 2,780lb. of H.E. from six D.H.9s on Durazzo during the morning of October 2, 1918.

Prisoners of War

NEXT of kin, if able to identify the men from the information published, are requested to advise the Casualty Branches of the Services concerned, forwarding Regimental or any other details.

The following is the latest list of British prisoners of war as received from enemy sources:—

In German Hands.—Sgt. A. E. Barlow, Lawson Close, Merton Park, London, S.W.; Sgt. C. H. Stevens, High Street, Brighton, Sussex; Sgt. R. P. London, Archery or Archway Grove, Woolston, Southampton; F/O. J. H. Frampton, Frome, Somerset; Sgt. Wade (address unknown), wounded, in hospital; Sgt. J. M. Garrett, P.O. Box 172, Auckland, New Zealand; P/O. P. J. Coulson, Rodenhurst Road, London, S.W.4; P/O. J. F. McFee, Ingleby Drive, Dennistoun, Glasgow; P/O. J. L. Scott, Pooks Hill, Bromborough, Cheshire.

Awards

THE KING has been graciously pleased to approve the following awards in recognition of gallantry and devotion to duty in the execution of air operations. The number after each name indicates the squadron with which the recipient is serving:—

APPOINTED A COMPANION OF THE DISTINGUISHED SERVICE ORDER.

Wing Cdr. J. A. POWELL, O.B.E., No. 149 Squadron.—One night in January, 1941, this officer was detailed to carry out an attack on the oil storage plant and refinery at Porto Marghera, Italy. Flying over his target, at a height of seven hundred feet, he scored a direct hit on the refinery. He then made a second run over the target in the face of considerable anti-aircraft opposition, and dropped two more bombs on the now fiercely burning building. Wing Cdr. Powell then flew on to Padua, where the aerodrome was machine gunned from a height of only twenty feet. He has displayed outstanding leadership, skill and courage in all his operational missions, and by his untiring efforts has raised the morale of his squadron to a high standard.

M.B.E.

ACT. FLT. LT. P. E. AXON, R.A.F.V.R.—One day in September, 1940, high explosive bombs were dropped on a Royal Air Force station by an enemy aircraft. A building which was occupied at the time by personnel on duty was seriously damaged. Flt. Lt. Axon showed great courage and coolness in the face of suspected unexploded bombs, and was continuously engaged throughout the night effecting repairs under trying conditions.

The re-establishment of operational service and the high standard of morale possessed by the station personnel reflects great credit upon Flt. Lt. Axon. This officer has exhibited courage and devotion to duty of a high standard, and has maintained the efficiency of his station in a praiseworthy manner.

BAR TO THE DISTINGUISHED FLYING CROSS.

Flt. Lt. J. A. F. MACLACHLAN, D.F.C.—No. 261 Squadron.—During intensive operations one day in January, 1941, this officer destroyed four and possibly five enemy aircraft. Ten days previously he destroyed two enemy aircraft, one of which he had pursued for many miles out to sea. Flt. Lt. MacLachlan has set a fine example of courage, initiative and leadership.

F/O. C. M. MILLER, D.F.C., R.A.F.V.R.—No. 148 Squadron.—This officer was pilot of an aircraft detailed to attack an enemy aerodrome. He carried out four accurate attacks, despite intense opposition from light and heavy anti-aircraft guns. On returning to his base, F/O. Miller offered to rearm his aircraft and make another flight to the same target, although he knew that one aircraft had already been shot down by anti-aircraft guns. He again obtained good results, in spite of his seeing another aircraft shot down. He has continually shown keenness, determination and courage of the highest order.

THE DISTINGUISHED FLYING CROSS

Squadron Leader John Anthony Hustler TUCK, No. 54.
Flight Lieutenant David William DONALDSON, R.A.F.V.R., No. 149.
Flight Lieutenant Percy Rodney O'CONNOR, No. 214.
Flight Lieutenant Victor Roberton PATERSON, R.A.F.O., No. 78.
Act. Flight Lieutenant Philipp Richardson CROMPTON, R.A.F.V.R., No. 9.
Act. Flight Lieutenant Leslie CROOKS, No. 53.
Act. Flight Lieutenant John James MCKAY, No. 102.
Act. Flight Lieutenant Donald Gordon OGILVIE, No. 44.
Flying Officer Eric Gordon BARWELL, R.A.F.V.R., No. 264.
Flying Officer Richard Melville CURTIS, No. 75 (New Zealand).
Flying Officer William Twiston DAVIES, No. 51.
Flying Officer Michael James Carr HARWOOD, No. 83.
Flying Officer Gordie Keith LARNEY, No. 75 (New Zealand).
Flying Officer John Douglas MUNDY, No. 85.
Flying Officer Colin Guy Champion RAWLINS, R.A.F.V.R., No. 144.
Flying Officer Roderick Malachi Seaburne RAYNER, No. 87.
Flying Officer Kenneth William TAIT, No. 87.
Flying Officer Philip Hampden TIPPETTS-AYLMER, No. 51.

ROYAL CONCERN: Her Majesty the Queen inspecting N.C.O.s of the Women's Auxiliary Air Force.

SERVICE AVIATION (Continued)

Flying Officer Peter John VALACHOS, No. 99.
Flying Officer Michael Hugh YOUNG, No. 264.
Pilot Officer Peter Edward BERRY, No. 9.
Pilot Officer Geoffrey Wilson O'Neill FISHER, No. 149.
Act. Flying Officer Harry Albert GOODWIN, R.A.F.V.R., No. 75 (New Zealand).
Flying Officer Leslie Oscar HALLS, R.A.F.V.R., No. 49.
Pilot Officer Douglas Ferguson LAMB, No. 9.
Pilot Officer Harry Thorne MITCHELL, No. 87.
Pilot Office John Lewis MITCHELL, R.A.F.V.R., No. 58.
Pilot Officer Terrence Deane WELSH, No. 264.
Pilot Officer Owen Edmund WILTSHEAR, R.A.F.V.R., No. 61.

F/O. A. WARBURTON.—No. 431 Flight.—This officer has carried out numerous long-distance reconnaissance flights and has taken part in night air combats. In October, 1940, he destroyed an enemy aircraft, and again in December he shot down an enemy bomber in flames. F/O. Warburton has at all times displayed a fine sense of devotion to duty.

Act. Flt. Lt. M. A. NEWLING, No. 145 Squadron.—This officer has been continuously engaged in active operations since May, 1940, and has at all times displayed marked courage and leadership. On one occasion during an attack against a large force of enemy bombers, he was shot down into enemy territory, but with great determination succeeded in gaining his own lines. Flt. Lt. Newling has destroyed at least three enemy aircraft and assisted in the destruction of several more.

Act. Flt. Lt. T. SMART, No. 65 Squadron.—This officer has performed valuable work over a long period of intensive air operations, including the Dunkirk evacuation and the mass attacks on this country. He has destroyed at least six enemy aircraft.

F/O. F. F. TAYLOR, R.A.F.V.R., No. 261 Squadron.—This officer has displayed the utmost gallantry and determination in combat, and seeks every possible opportunity of engaging the enemy. He has destroyed at least seven hostile aircraft, two of which he shot down in one engagement.

P/O. R. P. STEVENS, R.A.F.V.R., No. 151 Squadron.—This officer has performed outstanding work on night fighting operations during recent weeks. One night in January, 1941, he shot down two hostile aircraft in the London area. In both these engagements he chased the enemy over one hundred miles before destroying them at extremely short range. In one instance he followed the enemy aircraft almost to ground level from 30,000 feet. He has shown the utmost keenness and determination for operations in all conditions of weather.

ACT. F/O. M. H. MACFARLANE, No. 75 (N.Z.).—One night in January, 1941, this officer was the captain of an aircraft detailed to attack a target at Hanover. Weather conditions were bad, and with early prospects of a climb through 6,000 feet of cloud, were favourable to icing conditions. Soon after taking off, the wireless set became inoperative, but F/O. MacFarlane decided to continue. He successfully bombed his target and returned safely to his base without wireless aid, although visibility was poor and the cloud base was at less than 500 feet. On a previous mission he carried out a forced landing in the dark with only one engine, little damage being caused to his aircraft and none of his crew. F/O. MacFarlane has at all times displayed the utmost coolness, courage and devotion to duty.

BAR TO THE DISTINGUISHED FLYING MEDAL.

Flight Sergeant Edward Roland THORN, D.F.M., No. 264.
Sergeant Frederick James BARKER, D.F.M., R.A.F.V.R., No. 264.

DISTINGUISHED FLYING MEDAL.

Sergeant Eric Norman ALBERT, No. 75 (New Zealand).
Sergeant Lionel William BOVINGTON, No. 51.
Sergeant Val BURDETT, No. 75 (New Zealand).
Sergeant Archibald Murdoch COURBROUGH, No. 58.
Sergeant Robert James COUSER, No. 58.
Sergeant Albert Edward CRESSWELL, No. 51.
Sergeant Rex Ronald Boyce DURTNALL, No. 61.
Sergeant David George EVERSON, No. 83.
Sergeant Peter Charles Thomas FORSTER, No. 83.
Sergeant Sidney Horace FOX, R.A.F.V.R., No. 83.
Sergeant Christopher Ronald FROST, R.A.F.V.R., No. 144.
Sergeant Edward Frank FRY, R.A.F.V.R., No. 214.
Sergeant Stanley R. GEAR, R.A.F.V.R., No. 83.
Sergeant Francis William GREEN, No. 75 (New Zealand).
Sergeant Frank Briant HARWOOD, R.A.F.V.R., No. 144.
Sergeant Laurence Hamilton HAYDEN, R.A.F.V.R., No. 264.
Sergeant Ronald John HEALEY, No. 75 (New Zealand).
Sergeant Colin A. HUGHES, R.A.F.V.R., No. 58.
Sergeant Dugald McCALL, R.A.F.V.R., No. 99.
Sergeant Alexander Niven MACPHERSON, R.A.F.V.R., No. 9.
Sergeant George Oliver MAUGHAN, No. 102.
Sergeant Frank Harold PARKS, No. 58.
Sergeant Maxwell A. Dick RIDDELL, No. 61.
Sergeant Ernest R. SIMPSON, R.A.F.V.R., No. 49.
Sergeant Charles H. STEVENS, R.A.F.V.R., No. 58.
Sergeant Richard Noel STUBBS, R.A.F.V.R., No. 75 (New Zealand).
Sergeant Godfrey D. THOMAS, R.A.F.V.R., No. 83.
Sergeant Harold Hopper WHITEHEAD, No. 83.

Sgt. F. BASTARD, R.A.F.V.R.—No. 431 Flight.—This airman was observer of an aircraft the pilot of which was injured and rendered unconscious, causing him to fall forward over the control column. Sgt. Bastard, however, managed to take over the control and flew the aircraft level until the pilot recovered. He subsequently assisted the pilot, whose left arm was useless, by manipulating the throttle when landing on the aerodrome. His actions were instrumental in saving the aircraft and crew. He has also been engaged in numerous combats with enemy fighters, and has at all times displayed exceptional keenness and set a fine example.

AT EL ADEM: Air Comdre. R. Collishaw, D.S.O., O.B.E., D.S.C., D.F.C., surveys the results of R.A.F. units under his command after the capture of Tobruk. Air Comdre. Collishaw was at one time senior R.A.F. officer on H.M.S. *Courageous* and in the last war brought down 68 huns.

TO MINE ENEMY: Fixing a parachute mine on a Fairey Swordfish. These mines have been laid from Norway to the Mediterranean wherever enemy shipping has put in an appearance.

Middle East

DISTINGUISHED FLYING CROSS.

Wing Commander William Taylor Froest WIGHTMAN—No. 94.
Squadron Leader Robert Alfred MILWARD—No. 30.
Flight Lieutenant Graham Reese MAGILL—R.A.F.O. No. 47.
Flight Lieutenant Marmaduke Thomas St. John PATTLE—No. 80.
Flight Lieutenant Edward Maurice WARE—No. 228.

DISTINGUISHED FLYING MEDAL.

Sergeant Arthur FORD—No. 39.
Leading Aircraftman Reginald J. BARTON, No. 228.

One of the officers mentioned in the above list of awards has shot down at least thirteen enemy aircraft—three of them in one day. One day he was attacked three times by superior numbers. He destroyed two of the enemy before being shot down. After being twenty-four hours in the desert he crossed into friendly territory and made contact with our ground force.

Another officer has undertaken long and arduous patrols over a period of fifteen months. On one occasion when attacked by hostile aircraft his skill, combined with the high degree of training which he has instilled into his crew, enabled him to bring his Sunderland aircraft safely back to Malta.

Other recipients have carried out difficult attacks on Italian East Africa and Abyssinia. One organised and led three highly successful low-flying attacks on enemy aerodromes, involving a long sea crossing. His squadron destroyed six enemy fighters and five petrol dumps at Asseb aerodrome. He personally destroyed two petrol dumps and two enemy fighters.

One was gunner in a Sunderland aircraft which was attacked by enemy fighters. Although wounded in the leg he refused to leave his gun in spite of dense acid fumes. He continued to fire at the enemy.

Another air gunner was in an aircraft which was attacked by twelve enemy fighters. Although his gun ceased to fire he gave clear evading instructions to the pilot for twenty minutes, after which the fighters broke away.

Waziristan Medal

THE KING has commanded that the India General Service Medal, 1936, with clasp "North-West Frontier, 1937-1939," be granted to personnel of the Royal Air Force who took part in certain operations in Waziristan during 1937, 1938 and 1939. The operations covered three periods. The first was between December 16, 1937, and December 31, 1938; the second lasted from June 16 to November 1, 1938; the third was from January 1 to December 31, 1939.

The areas in which service with R.A.F. units will qualify for the grant of the medal and clasp lie between the Indo-Afghan frontier, the River Indus and Baluchistan. They include parts of Kurram, Kohat and Bannu. Officers and airmen who served with R.A.F. units which operated from Peshawar, Risalpur, Kohat and Fort Sandeman during the same periods will also be eligible for the medal and clasp. Those previously awarded the medal will receive the clasp only, and neither medal nor clasp will be issued to R.A.F. personnel while serving during the present war.

Correction

CASUALTY COMMUNIQUE No. 59.

Under "Missing, Believed Killed in Action":—The correct service number of Sgt. N. W. Mawby is 755296.

Under "Previously Reported Missing, Now Presumed Killed on Active Service":—A.C.1 A. J. Morn, 62347, should read Moran.

Correspondence

The Editor does not hold himself responsible for the views expressed by correspondents. The names and addresses of the writers, not necessarily for publication, must in all cases accompany letters.

THE OBSERVER CORPS

Action Demanded

MANY Observers will have read with great interest the article in your issue of January 2nd under the heading "Nobody's Baby."

Although all the statements are not entirely accurate, I am sure we all endorse the fact that we do appear to be "Nobody's Baby."

Having some small knowledge of the control and direction of our fighter aircraft, I have often wondered if the very reason for our being "Nobody's Baby" is that, like most discarded infants, *we are not wanted* by anybody.

If this should be the case, then the sooner someone in authority takes the matter in hand the sooner will the country be saved several millions of pounds, thousands of gallons of petrol, and the release of hundreds of youngish men for more useful work. ENQUIRING OBSERVER.

GROUND ENGINEERS' EXAMINATIONS

Changes Suggested

I HAVE read with interest the article by Mr. T. R. Thomas, published in *Flight* of December 19th, 1940, entitled "Ground Engineers' Examinations." In reply, may I put forward a few suggestions?

I should first like the title altered from "Ground Engineer" to "Aircraft Engineer," as this latter title is more indicative of the class of engineering concerned. A Ground Engineer might be a landscape gardener, whereas Aircraft Engineer is quite clear. Secondly, I should like "Licence" to be altered to "Certificate." A licence is a permit to do something, whereas certificate is a written testimony to the truth of any fact. In this case the fact would be that the applicant, having passed the examination, is hereby certified as a competent person within the meaning of the "Air Navigation Act." Now as to categories, I entirely agree with Mr. Thomas that the categories should all be in two parts on the lines that he suggests; that is, the first parts to cover single-engined aircraft of less than a certain weight or engines of less than a certain power, and the second parts over these weights and powers.

The syllabus for these examinations would have to be of a much more general character than is required at present, which, in my opinion, would be all to the good. Now, the minimum time laid down before sitting for the examination is two years for any category. This, I suggest, should be modified as follows:—

Two years' experience before sitting for the first part of "A" or "C," or two years before sitting for the second part of "A" or "C" if taken separately, and three years before sitting for both parts of "A" and "C" if taken together. Regarding "B" and "D," five years before sitting for the first part, which would be up to the standard of fitting approved parts only, and for the second part of "B" or "D," five years with proof of apprenticeship period or experience in the actual construction of aircraft or engines.

In this way an applicant can take the examination for which his experience qualifies him. For example, an applicant whose experience was solely confined to the construction, overhaul and testing of engines could take the second part of "D" category, but not the first part, as he had had no aerodrome experience, which would allow him to progress in his own line and he then could become an Inspector in place of an Approved Inspector, whose qualifications and experience are often limited.

I also agree with the suggestion that the first part of the examination should consist of a written paper, as theoretical knowledge is essential in the diagnosis and correction of faults.

On the question of the issue of a "super" certificate, this would not apply if the categories were as I have suggested, as the holder of all four categories in both classes would have all types, but a "super" certificate could be issued to the holder after a number of years and having been continuously employed in the aircraft industry; and this is where the "discharge" book would come in useful. Regarding the question of renewal, this again could depend upon the "discharge" book. I suggest that at the expiration of a year the "discharge" book only is sent up, and if this shows that the applicant has been continuously employed in the aircraft industry, renewal is automatic, but if not employed in the aircraft industry for a period of two years, renewal by re-examination would be necessary. S. T. WEEDON.

Suggested Raising of Required Standard

MR. T. R. THOMAS'S recent article must have been of great interest to ground engineers, and yet his appeal for ideas has met with little response from the self-styled P.B.G.E.s. One hopes the energetic Air Registration Board will not be discouraged by this lack of interest. The present G.E. system, concocted by the A.I.D. in 1919, obviously needed amendment before the outbreak of war, and it seems that now is the time for the responsible authorities to put the amendments in hand in preparation for post-war days. Most people concerned consider that the standard of examination should be raised, and, if a ground engineer's capabilities are to be assessed by his licence holding, then I feel that the Examination Board should demand a higher general engineering knowledge from candidates.

I suggest the following amendment of the present system:

(1) Delete "Types" from all categories and substitute, in the case of "A" and "B," aircraft with a maximum all-up weight of (a) 2,000 lb., (b) 10,000 lb., (c) unlimited. For the "C" and "D" categories, engines up to (a) 200 h.p., (b) 500 h.p., (c) unlimited.

(2) Examine candidates progressively, *i.e.*, a candidate must pass (a) before sitting for (b), and should be prepared to be examined on at least two current aircraft or engines in each sub-division.

(3) The initial examination should ascertain that the successful candidate is capable of (a) reading a drawing; (b) using a micrometer and a vernier; (c) writing an intelligent inspection, overhaul or damage report.

(4) Demand from a candidate proof of at least four years' practical experience or apprenticeship, or two years' practical experience in addition to college or technical school training.

(5) Prove by written examination that a candidate has a reasonably good knowledge of A.N.D. requirements.

Mr. Thomas's reference to a Certificate of Competence is interesting, but I feel that it should be closely allied to the present G.E. licence. The certificate could be granted to a ground engineer who has spent at least ten years in the industry with an unblemished record, and whose licence covers a minimum number of categories. Before granting the Certificate of Competence there should be no doubt that the ground engineer has attained a reasonable standard of education and has a good knowledge of general engineering.

G.E. 872.

NIGHT BOMBER DEFENCE

Turreted Fighters Urged

AT the risk of being a nuisance, or being branded a crank, I rush to write once more on the subject of fighters. In a recent *Flight* we read that "the only real defence against the night bomber is the night fighter," and that the Norwegian campaign was partly lost because of a lack of long-range or escort fighters. At a time when we are on the verge of an invasion in which the Hun, so the popular Press assures us, will use 36,000 aircraft, I do feel it urgent that someone, somewhere, should seriously consider the use of the long-range fighter equipped with two or more power-driven gun-turrets. I mention this because I believe that, wonderfully effective as are single-engined fighters with fixed guns, twin-engined, long-range machines with movable armament would be two or three times as effective.

There are several reasons for this, and one of the most important is that, usually, to increase range the designer must

CORRESPONDENCE (Continued)

increase the size and decrease manœuvrability. Hence the use of rotating armament is urged. Also a fighter which aims its guns with itself must often turn away from its target to avoid collision and consequently present its side or belly to the enemy's gunners. The turreted machine can fly alongside, above, below, or even in front of the enemy without turning away, and pour in its cannon-shells or rounds of 0.303 without aerobatics. It can also fly into a Hun formation, and its different turrets can engage two or even three machines at once. I feel sure that a certain amount of armour plating and our undoubted superiority in turret design and armament would result in colossal losses to the Nazi bombers, which at best mount only two guns per man, and those usually (one might say invariably) on hand-operated mountings.

It is only necessary to add that certain types of bomber appear to be capable of converting into these types of machines practically on the spot, and that at least two types of fighter coming along should have the range (but rely on fixed armament) to prove that I am not advocating something theoretical or possibly only capable of production in five years' time.

Other people besides myself have advocated the long-range turret fighter, but no one seems interested in influential circles. I should like to know why not? I hope that this letter may bring the subject out in the open once again.

I feel sometimes that there is a terrible inertia in some influential circles which may one day cause us to drag out Harts and to fit Tiger Moths with 1918 Lewis guns in order to stem the tide of Nazi thoroughness and numbers. Let us hope that this day will never arise. If we prepare and it does not, well and good; if we are unprepared or not sufficiently tortuous to meet the cunning German, we all know what to expect.

ERNEST P. BRODIE.

OLD-TIMER DOES HIS BIT

Now an Instructor in Canada

AS a regular reader of *Flight* I was very much interested in the article "Eyes for the Army" of the January 30th, 1941, issue, which quoted a citation of the Great War, '14-18, regarding Lieutenant A. W. Hammond in a "Big Ack" machine.

Mr. Hammond has been a personal friend of mine for many years in Winnipeg, Canada, and despite the loss of a leg in this action, "A. W." was such that he became a very ardent golfer, swimmer, and automobile driver, but modest withal regarding his service and exploits. I thought that *Flight*, and perhaps some of its readers, would be interested to hear that Mr. Hammond has once more volunteered his services to the R.A.F., or I should say the R.C.A.F., in the capacity of instructor somewhere in Eastern Canada. I could supply his address if any person wishes to communicate.

E. E. ESAU.

SPIN TECHNIQUE

Use of the Stick in Recovery

IN your issue of December 26th, 1940, you published an article on Royal Air Force Instruction, and one paragraph was headed "New Spin Technique." This paragraph is very misleading and advises a wrong technique which may lead to accidents, if taken seriously. It is, therefore, to be hoped that you will contradict it in bold type as early as possible.

This School is directly concerned with any new flying training technique and its Instructional Staff is surprised to hear that the new technique is to "put on opposite rudder and stick forward simultaneously—and with no apologies."

THERE IS *NOT* A NEW TECHNIQUE. The correct method of recovery is according to the drill described below and quoted from the Royal Air Force Flying Training Manual. There should be a slight pause between the actions:—

"*SPINNING.*

"*Recovery.*

FULL OPPOSITE RUDDER is the first and permanent requirement for recovery. Auto-rotation must be stopped and easing off the opposite rudder at any time will never help recovery, but invariably prolong the spin. This should always be done on all types, as, even if some aeroplanes will stop with less than full rudder, it never does any harm, and it is vitally important to form this habit. The pilot learns to use rudder intelligently, the moment the spin stops, to eliminate further yaw.

"The drill is as follows:—

(i) FULL OPPOSITE RUDDER. This may be applied sharply and must be maintained until the spin stops, whatever other actions are necessary.

(ii) Ease the stick steadily forward until the spin stops. If the spin stops before the stick is right forward, hold it in position to keep diving straight.

(iii) As the spin stops centralise the rudder, using it to eliminate yaw; and gather ample speed to ensure that easing the aeroplane out of the dive will not stall it again.

(iv) Ease gently out of the dive with the elevator.

"Prolonging the dive (not necessary with light aeroplanes) is most essential with modern aircraft of high wing-loading. It is not enough to see that the airspeed is just above "stalling speed"—remember that stalling depends directly on angle of attack and not directly on speed.

"The stick must not be put unnecessarily far forward, as if this is done a very steep dive will result. It must not, on any account, be moved forward before the rudder is applied as this almost always results in a higher rate of rotation and, sometimes owing to centrifugal force, subsequent flattening. This is probably due to stalling of the tailplane with the increased virtual angle of attack caused by depressing the elevator. The full explanation of it involves higher mathematics and need not bother the pilot."

It is unfortunate that the Harvard Trainer should have been mentioned in your article, as this aeroplane is one in which the correct method as advised above is *essential* to recovery.

E. C. KIDD, Sqn. Ldr.,
Deputy Chief Flying Instructor,
Central Flying School.

[The statement in question occurred in an article on the work of an Elementary Flying Training School, and was written by a member of our editorial staff (who holds a pilot's A-licence) after a visit to the school. The "new technique" was described to him on the aerodrome by a flying instructor who had just stepped out of a Tiger Moth and sent his pupil off solo. It was not given officially, as part of the visit, but it appears unlikely that our representative misunderstood what he was told, as it was the very unusualness of the statement which made him especially interested.—ED.]

DESIGNING FOR PRODUCTION

Apprentice Problem a Vital Aspect

THE recent correspondence under the above heading touches on a very broad and contentious subject, the roots of which lie deep in the history of the previous generation, and the matter of apprenticeship amongst the members of the drawing office staffs in the aircraft industry is but one fibre. The problem is part of a legacy from the Great War, which drained the financial resources of commerce and industry and at the same time gave less-favoured nations an opportunity to compete and establish lower standards than we had previously maintained. The get-rich-quick spirit amongst young people has caused them to shy at tying themselves down to low wages over a period of five to six years. Their motives are not always so selfish as might appear on the surface; their parents, having been hard hit by taxation during their non-productive years, naturally encourage their offspring to go after something more remunerative.

In addition to the foregoing, the trend of post-Great War years was towards specialisation to a degree that a fully fledged apprentice very often found himself in the unenviable position of knowing a bit too much, compared with the general run of specialised workmen, whose experience is often founded on correspondence courses only.

During the Great Depression skilled workers in many trades were found to be "too old" at forty. Naturally, these "old men" could not conscientiously advise any junior to pursue an apprenticeship which brought them to this condition at such an early age. We are now reaping the benefit of this short-sighted policy and consequently have to appeal to our American cousins to help us out of the ditch.

In a recent edition of a local paper the subject of apprenticeship had been discussed among some local officials, and the subject of premiums was the main plank of the discussion. In other words, they were still thinking along the lines of 1840 and not 1940.

If British commerce and industry is to regain its prestige in the markets of the world it will be well worth while to pay apprentices a bounty in order to encourage them to take up a skilled trade, rather than to make the process of learning an expensive one for them and their parents.

P. B. D.

SEEING FOR HIMSELF: Mr. Wendell Willkie toured the munition factories of Coventry before returning to America. He is seen here with Mr. W. E. Rootes, who is chairman of the Coventry Reconstruction Committee.

Flexible Remote Control

A TREATISE has been prepared by the S.S. White Co. of Great Britain Ltd. to help engineers and design staffs on problems connected with flexible remote control. It deals with many actual applications and application procedure. There is also a series of curves showing graphically the relationship between load on the shaft and torsional deflection for a number of examples. Finally, there are eleven different end fittings illustrated to show the variety of applications.

Copies of this treatise may be had from the S.S. White Co. of Great Britain Ltd., Britannia Works, Saint Pancras Way, Camden Town, London, N.W.1.

Hand Cleaner

WAR work in the factories and workshops is to-day being done by many pairs of hands which are unaccustomed to such treatment. For these a satisfactory hand cleaner comes as somewhat of a blessing, and the new Perox-Chlor, placed on the market by Keenes Laboratories, Ltd., appears to fill the bill.

From the name it is clear that the main ingredients are peroxide of hydrogen and chlorine. The former is, of course, the famous bleaching agent used by synthetic blondes, and chlorine is one of the best-known antiseptics. It is claimed that Perox-Chlor will remove all dirt and marks from the hands—even stains caused by ink, tobacco or photographic chemicals—without the slightest injury to the skin. Other uses for which it is suitable are paint cleaning, dry cleaning fabrics, as a dental plate cleaner, and it can even be used for shampooing the dog! Perox-Chlor is obtainable from all chemists, in tubes or jars priced 1s. 3d. or 3s.

New Perkins Appointment

MR. J. V. GIL, M.I.E.E., late Technical Director of The Kohler Co., Ltd., of Great Portland Street, London, W.1, has been appointed Chief Electrical Engineer to F. Perkins, Ltd., of Peterborough.

For some time past Mr. Gil has had considerable experience in the marketing and installation of the well-known Kohler-Perkins high-speed automatic Diesel plants, and has been personally responsible for the development of the special electrical apparatus involved. He is to be congratulated on his appointment, which follows the marketing of an automatic Diesel generating set of their own design by F. Perkins, Ltd.

No Change

DOWTY EQUIPMENT, LTD. (formerly Aircraft Components, Ltd.), draw our attention to a paragraph in our issue dated January 23rd, giving their address as Bedford Hotel, North Promenade, Blackpool. They point out that they have never had a temporary address at Blackpool or elsewhere. The paragraph was inserted on information from a source which is usually reliable.

Eye Comfort Returns

THE famous Meyrowitz Luxor No. 10 Goggles, which have been out of production for some time past, are once more available for those who enjoy the comfort of having only the very best. Their extreme lightness and moulded rubber pads enable them to be worn for long periods without any discomfort. Special attention has been given to ventilation, in order to avoid misting of the lenses, and there is a micrometer adjustment for the nose-bridge. Ordinary lenses are fitted in the normal manner, but the construction is such that there is no difficulty in fitting prescription lenses if required.

EYEABLE: The Meyrowitz Luxor goggle, showing the adjustable nose-bridge and ventilators.

The address of E. B. Meyrowitz, Ltd., is 1A, Old Bond Street, London, W.1.

THE INDUSTRY

PUBLICATIONS RECEIVED

"Landfall": A Channel Story, by N. Shute; 8s., William Heinemann, Ltd., 99, Great Russell Street, London, W.C.1.

Squadrons Up! by Noel Monks; 12s. 6d., Victor Gollancz, Ltd., 14, Henrietta Street, London, W.C.2.

The R.A.F. in Action; 7s. 6d., Adam and Charles Black, Ltd., 4, Soho Square, London, W.1.

Mechanical World Year Book, 1941; 2s., Emmott and Co., Ltd., 31, King Street West, Manchester, 3.

Dive Bomber, by R. A. Winston; 3s. 6d., George G. Harrap and Co., Ltd., 182, High Holborn, London, W.C.1.

The Royal Air Force in Pictures; 5s. Country Life, Ltd., 20, Tavistock Street, London, W.C.2.

The Observer's Book on Astro Navigation, Parts I and II, by Francis Chichester; 2s. 6d. each. George Allen and Unwin, Ltd., 40, Museum Street, London, W.C.1.

The Spotter's Handbook, by Francis Chichester; 5s., George Allen and Unwin, Ltd.

Air Mail Magazine for 1940; 2s. 6d., A. Phillips, 4, Dock Street, Newport, Mon.

Wings of Victory, by Ivor Halstead; 6s., Lindsay Drummond, Ltd., Buckingham House, Buckingham Street, London, W.C.2.

England is My Village, by J. L. Rhys; 6s., Faber and Faber, Ltd., 24, Russell Square, London, W.C.1.

Aircraft of the Fighting Powers; 10s. 6d., Harborough Publishing Co., Ltd., Allen House, Newarke Street, Leicester.

Hiduminium Technical Data; Booklet. High Duty Alloys, Ltd., Trading Estate, Slough, Bucks.

NEW COMPANY

L.F.S. (AIRCRAFT), LTD.—Private company. Registered January 30th. Capital, £3,000 in 3,000 shares of £1 each. Objects: To carry on the business of contractors for the salvage of wrecked and damaged aircraft, haulage and transport contractors, etc. The directors are: John W. Irlam, 59, Knutsford Road, Wilmslow, Ches., haulage contractor (permanent); Norman B. Jones, 29, Greenheys Lane, Manchester, 15, acct.; Wm. F. Lamont, 76, Norfolk Avenue, Thornley Park, Denton, Manchester, manager; Maurice Rubin, "Danesmoor," Daylesford Road, Cheadle, Ches., solicitor. Solicitors: Maurice Rubin and Co., 29, Brazennose Street, Manchester, 2. Registered Office: 99, Great Jackson Street, West Gorton, Manchester, 12.

AERONAUTICAL PATENT SPECIFICATIONS

(Published December 12th, 1940.)

1939.

10136. FAIREY, C. R. Safety devices for aircraft (528,063).

11376. BONSTOW, T. L., and MARGOLIS, A. E. Assisted take-off of landplanes (529,243).

14125. BRISTOL AEROPLANE CO., LTD., and NIXON, F. Air-intakes for aircraft engines (529,057).

15095. BOULTON PAUL AIRCRAFT, LTD. (Soc. D'APPLICATIONS DES MACHINES MOTRICES.) Sighting means for guns (529,078).

15631. ARADO FLUGZEUGWERKE GES. Float for aircraft (529,269).

15697. STANDARD TELEPHONES & CABLES, LTD. Directional aerial arrays (529,288).

16058. GRIFFITHS, E. J. Aircraft landing-gear (529,087).

(Published December 19th, 1940.)

1939.

5395. AKTIEBOLAGET BOFORS. Percussion fuses for aerial bombs (529,505).

6489. REYNOLDS, L. G. S. Mechanical course predictor for use in vessels at sea and aircraft in the air at night (529,307).

14601. WHITNEY, C. Aircraft (529,388).

15052. BLACKBURN AIRCRAFT, LTD., JOHNSON, J. B. E., and TOPLIS, J. G. Fuel-supply systems for aircraft (529,516).

15942. HENSCHEL FLUGZEUG-WERKE AKT.-GES. Aircraft cabins (529,362).